History and Archaeology
65

AGRICULTURE ON THE PRAIRIES, 1870-1940

David Spector

3 ANIMAL HUSBANDRY ON THE CANADIAN PRAIRIES, 1880-1925

107 FIELD AGRICULTURE ON THE CANADIAN PRAIRIES, 1870-1940

215 W.R. MOTHERWELL'S FARMING OPERATIONS

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Front Cover: Two men stooking wheat. (Saskatchewan Archives Board, Photograph No. RA 6574.)
Back Cover: *Top*, cultivator, ca. 1920 (Provincial Archives of Manitoba); *bottom*, threshing on a farm near Olds, Alberta, 1912 (Glenbow-Alberta Institute).

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ANIMAL HUSBANDRY ON THE CANADIAN PRAIRIES, 1880-1925

David Spector

4 Abstract
5 Introduction
7 Encouraging Animal Husbandry
  7 Three Advocates of Mixed Farming: John G. Rutherford, W.R. Motherwell and W.A. Wilson
  11 The Agricultural Press and Mixed Farming
  14 Role of the Dominion Government
  19 Role of the Saskatchewan Government
  24 Role of the Saskatchewan Agricultural College
  25 Conclusion
26 The Extent of Veterinary Science and Animal Husbandry Advances, 1880-1925
  26 The Ontario Veterinary College
  27 Developments in Veterinary Science
  37 Improvements in Animal Husbandry Techniques
  42 Advances in Farm-Building Technology
  47 Conclusion
48 Non-Technological Limiting Factors in Prairie Animal Husbandry
  48 Forage Crops
  50 Building Costs of Mixed Farming
  50 Hypothetical Cost Comparisons of Grain and Mixed Farming
  58 Conclusion
59 Horse Raising on the Prairies
  60 Triumph of the Clydesdale
  61 Advances in Treatment of Horse Diseases
  64 Improvements in Horse Breeding
  66 Improvements in Care and Feeding of Horses
  68 Federal and Provincial Initiatives to Promote Horse Raising
  70 Conclusion
71 Animal Husbandry in the Qu'Appelle Valley
  71 Statistical Comparisons of the Qu'Appelle Valley and Other Saskatchewan Regions
  77 Dairy Farming in the Qu'Appelle Valley
  80 Extent of Mixed Farming in the Qu'Appelle Valley
  82 Conclusion
88 Conclusion
90 Endnotes
103 Bibliography

ABSTRACT

Between 1880 and 1920 animal husbandry played a supportive role to the dominant cereal grain agriculture on the Canadian Prairies. Developments in livestock breeds, animal disease control, and the improved technology of animal shelters made livestock raising feasible in the West. Many farmers raised small numbers of cattle, pigs and other livestock to provide food for their families, an ancillary income, and a bulwark against field-crop disasters. Yet the predominantly rich black and brown soils of the Prairies proved more profitable in the cultivation of wheat and other field crops. Despite the encouragement of W.R. Motherwell and other agricultural officials to diversity, prairie farmers showed a persistent reluctance to adopt mixed farming on a significant scale.

Submitted for publication 1978, by David Spector, Parks Canada, Prairie Region, Winnipeg.

INTRODUCTION

Dry-belt animal husbandry as a part of mixed farming played a secondary role to wheat cultivation in the western provinces from 1880 to 1930. Its subservient status can be attributed to a number of factors. Wheat growing was seen first and foremost as the farmer's path to profit. Requiring neither barns, silos, nor costly forage crops and only six months' labour per year, Red Fyfe and Marquis wheats easily provided a greater return for each dollar invested and spent. Geographical factors and technological gaps constituted major obstacles to increased livestock raising. Water shortages, inadequate barn technology, and difficulties in shipping the finished product to market outweighed the benefits of veterinary advancements and animal raising improvements brought about by such pioneers as Duncan MacEachran and John Gunion Rutherford. In short, wheat came to be preferred over husbandry in cattle, sheep, swine and poultry as well as dairying because it was more profitable and practical.

Statistics indicate that Saskatchewan's livestock industry from 1908 to 1928 provided annual returns varying from one-fourth to one-half of the income derived from wheat.[1] Generally grain and livestock were affected by similar market trends, although livestock prices were not subject to the violent fluctuations of wheat prices. Production figures in both commodities followed the same pattern, wheat acreage expansion and animal numbers increased simultaneously, the latter expanding at a much reduced rate.

In the context of price and production movement three distinct phases can be observed from 1908 to 1928. The first, 1908-19, saw abrupt livestock and wheat production increases accompanied by high market returns. The economic recession of 1920-30 reduced incomes but increased animal numbers. The final phase, 1924-28, saw an increase in wheat acreage but none in livestock returns. One statistic remained unchanged - a two to one earned income ratio favouring wheat.

The supremacy of wheat was established in the years 1908-19, although livestock production also increased substantially. The price of wheat rose from a low of $.66 per bushel in 1913 to a figure three times as great in 1919.[2] Likewise, wheat production tripled in this period. With respect to livestock, swine and beef cattle increased by 500 per cent, dairy cattle, four, and sheep, three. Still, despite expanding production, livestock returns remained secondary to wheat, ranging from 38 per cent of the wheat income in 1909 to 50 per cent in 1919.

The early 1920s recession brought declining prices to all agricultural products. Wheat plummetted by more than one-half during 1920-30. Lesser reductions in livestock values reflected the more stable nature of their market. Meanwhile, production surprisingly increased: wheat expanded from ten million acres in 1920 to 12.8 three years later, swine doubled in numbers, although beef cattle registered a slight increase, sheep remained constant. Throughout the era, the subordinate role of animal husbandry remained unaltered, livestock fluctuating from 44 per cent of wheat's value in 1920 to 35 per cent in 1923.[3]

The importance of wheat to the dry-belt economy in Saskatchewan was amplified further between 1924 and 1928. Wheat and livestock prices made slight recoveries but individual returns were not equal to those of the latter war years. Wheat acreage rose by 750,000 but the livestock count remained constant. By 1928 yellow gold overshadowed all else, its value being placed at over $247,000,000 by the Saskatchewan Department of Agriculture. On the other hand, income from swine, sheep, beef and milch cattle totalled only $60,000,000, less than a quarter. Clearly the livestock industry played only a supporting role in Saskatchewan agrarian economy.

Any study of the livestock industry during its formative years must account for its subservience to wheat cultivation. Topics such as government and agricultural college promotional efforts, veterinary and animal-rearing gaps and achievements, mixed-farming versus grain-growing cost analysis, and the study of horse raising merit attention. Also useful would be a case study outlining animal husbandry's problems in a confined geographical area.

Efforts at encouraging animal husbandry become significant mainly because of initial provincial and federal government reluctance to participate. Standing alone, before 1919, individuals such as John G. Rutherford and W.R. Motherwell, the agricultural colleges and the press were confronted with an impossible task. Provincial and federal government assistance in the wake of the 1920s recession proved too little too late.

Technological gaps negated the advantages derived from improvements in veterinary science and livestock rearing. The elimination of animal disease through the development of anti-toxins and progressively more stringent federal animal quarantine procedures were counterbalanced by problems in constructing moisture-free barns and silos. With ever-prevalent problems involved in wintering livestock, farmers appeared reluctant to increase production.

As the one success in animal husbandry, the horse derived its importance as a result of its tie to grain growing. Since the horse served as the means of propelling agricultural implements, incentives existed for improving breeding, rearing, feeding and disease control techniques. With ever-expanding wheat acreages, however, the demand for Clydesdales and Percherons outstripped the supply.

ENCOURAGING ANIMAL HUSBANDRY

The animal husbandry cause in wheat-growing areas of the prairie dry belt emerged as one to which a number of individual and corporate advocates directed their attention. Such leading agriculturalists as John Gunion Rutherford, William R. Motherwell, and W.A. Wilson could be found in the vanguard. The agricultural press also played a prominent role. Both the *Nor'-West Farmer* and the *Saskatchewan Farmer* were notable for their exhortations in favour of farm diversification. Agricultural colleges completed the list of totally dedicated proponents by distributing large quantities of propaganda and providing short- and full-length course offerings. Only the federal and provincial governments failed to exercise fully their responsibility. Unconvinced of the efficacy of wheat-belt animal husbandry during the pre-1920 era of high grain prices, the Dominion and Saskatchewan governments engaged in only limited promotional efforts. With the early 1920s' recession both sides altered their position, but the conversion came too late to be effective. It was this lack of governmental initiative that chiefly negated the efforts of individuals, journals, and agricultural colleges to promote the raising of livestock.

Three Advocates of Mixed Farming: John G. Rutherford, W.R. Motherwell and W.A. Wilson

The major proponents of farm diversification were prominent agriculturalists. Chief among them was the Dominion Livestock Commissioner, John G. Rutherford, who devoted numerous farm periodical articles to the advantages of stock rearing. Saskatchewan's Minister of Agriculture, W.R. Motherwell, also strongly advocated mixed farming, however, his department appeared mesmerized by wheat-growing successes and did little to transform his ideas into concrete policies. Only W.R. Wilson, Saskatchewan's Dairy Commissioner, expressed doubts concerning animal husbandry's future in Saskatchewan despite the fact that his entire career was spent in its promotion. These were the men who hoped to develop the livestock industry as the equal of grain growing and failed.

John G. Rutherford appealed to farmers' pride in urging them to take up animal husbandry. Unlike the grain grower, Rutherford claimed, the livestock producer was a "real farmer" because he was able to produce many of the commodities that his wheat-cultivating friends were forced to purchase. The stockman was "a man of advanced thought and ideas" who, as a rule, read more and was "infinitely better informed and more interested in agricultural matters than his neighbour whose

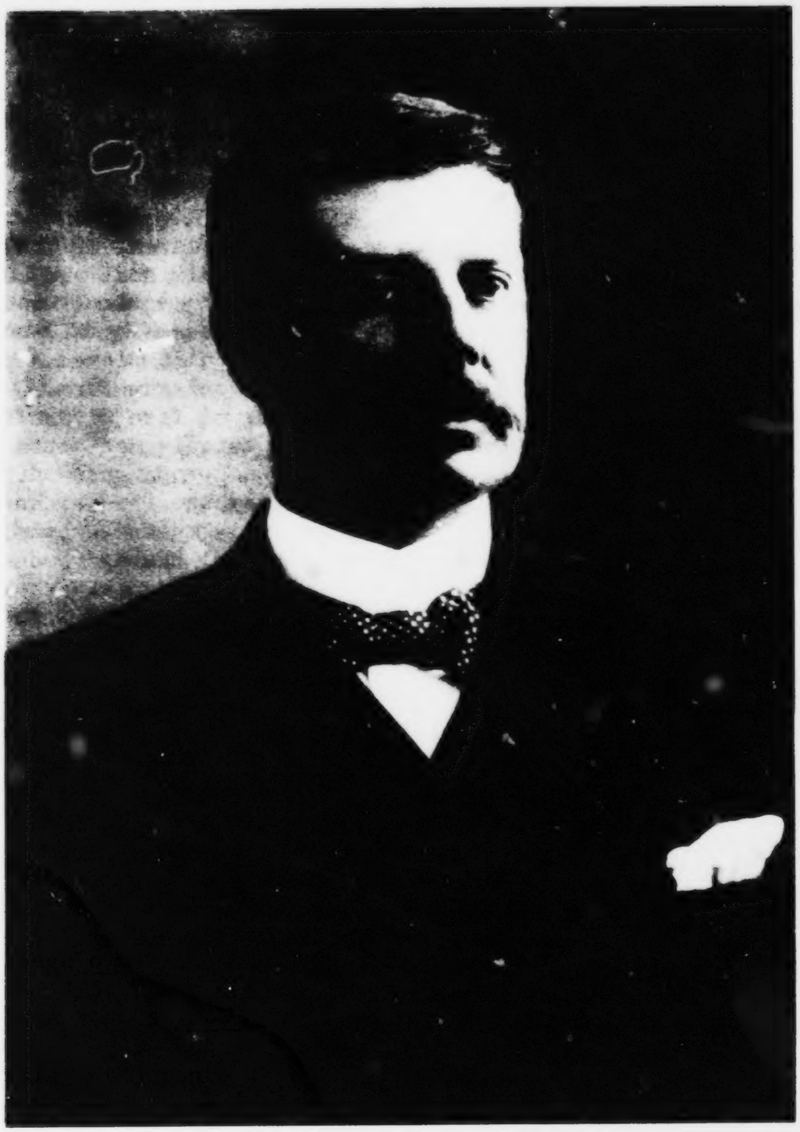

Figure 1. John Gunion Rutherford, 1892. (Provincial Archives of Manitoba.)

sole study [was] the grain market and who for nearly half the year [had] nothing to occupy his time and attention." Rutherford also hinted that the mixed farmer's enhanced social prestige could be handed down to his sons. While grain-growers' sons were doomed to acquiring a knowledge of "wheat and weeds," those of the stockmen possessed the potential to become the "best representatives of the younger generation of Canadian agariculturalists."[1] By dangling the carrot of social respectability, Rutherford hoped to coax grain growers into livestock production.

Still, Rutherford's more convincing arguments centred on economics. He believed livestock would not only adapt to prairie conditions but could produce reasonable profits. He described the prairie in hyperbole. It was supposedly unequalled for animal breeding and feeding, unexcelled in its capacity to sustain forage crops, and blessed with excellent transportation facilities linking the region to major markets.[2] At the same time, livestock rearing possessed none of the disadvantages of grain growing, to which the farmers had been blinded by a series of bumper crops. Rutherford offered the veiled threat that farmers would soon realize the "prosperity born of exclusive grain farming could be only temporary in its nature."[3] Eventually they would see that livestock production constituted a profitable undertaking as well as a hedge against single crop disaster.

Animal husbandry offered much to the prairie farmer. If provided with proper shelter during the winter, Rutherford asserted that beef and dairy cattle would thrive. With an abundance of feed always available, hogs could be raised economically. Even sheep offered opportunities to potential stockmen. "There are but few plants which the sheep will not readily eat, and the judicious use of a small flock on the summer fallows and stubbles of a weed-infested farm invariably shows more gratifying results." Above all, livestock would find open markets. Expanding urban centres required vast quantities of dairy produce. Dry-belt produced swine could be processed by British Columbia and eastern Canadian packers. British Columbia, eastern Canadian, northeastern United States, and British buyers proved eager to purchase prairie-bred sheep - so much so Rutherford could claim "the only reason why Canada has ceased to ship mutton sheep to Britain is that she no longer has any to spare."[4] In short, Rutherford painted a glowing picture of opportunities available to animal husbandmen, and indicated, somewhat sanguinely, that the road to success possessed few pitfalls.

W.R. Motherwell's appeal for increased livestock production tended to concentrate on the more mundane, if not more realistic, issue of profit potentials. Although he believed the lack of animal industry could be attributed to the farmers' desire for a short working year complete with windfall returns, he chastized animal husbandry proponents who used the issue of moral reform as the basis of their arguments. The key to converting farmers lay not in preaching the value of 12 months' work, but in providing evidence of animal husbandry's profitability.[5] To this end Motherwell geared his case.

Motherwell's arguments in favour of animal husbandry were consistent, but one-dimensional. Livestock rearing offered the husbandman the opportunity to produce draft horses, bacon, and beef for his own use and consumption as well as providing a reasonable return from the sale of surplus. The extent to which each type of animal was raised depended, of course, on the state of the market. In 1907 horses and hogs were recommended. Since they were procurable from eastern importers only at three times their production costs, Motherwell suggested that farmers could raise their own Clydesdales more economically. Likewise, hogs sold for prices "that one squirms at paying when it is a case of buying," but required little capital outlay to secure a fair return.[6] Seven years later Motherwell recommended that hog production be curtailed and sheep and cattle substituted. At the height of the war, hogs were being fed on commercially produced grasses. As grain prices had soared to astronomical heights it was felt more economical to raise cattle and sheep on non-commercial roughage.[7] Clearly, livestock rearing's profit potential stood as the overriding plank in Motherwell's promotional efforts.

Among animal husbandry's leading exponents, W.A. Wilson is notable because he confined his activities to dairy promotion. However, his failure to establish the North-West Territories' dairy industry on sound footing tempered his later enthusiasm as Saskatchewan's Dairy Commissioner. Throughout his long career his attitude towards the promotion of animal husbandry was somewhat cautious.

Before 1906, Wilson was primarily concerned with laying the foundation for a viable dairy industry. Avoiding the unabashed "boosterism" of Rutherford and Motherwell, he believed that improvements in produce quality held the key to expanded markets and increased returns. With respect to dairy products, Wilson stated that avoidable contamination needlessly prevented large quantities from ever reaching the market. At that time, dairy products passed from farmer to merchant and consumer uninspected. Suggesting the introduction of a grading system, he predicted that it would be beneficial to the entire industry.[8]

Wilson's aversion to unjustified expansion expressed itself in his plan for rational dairy growth. Responding to a letter from a Saskatchewan resident who desired a creamery in his district, Wilson warned that "it [was] very necessary that the introduction of dairying into any district be proceeded with very carefully, because there is a strong tendency, when times are prosperous, for the farmers to foresake the work." As far as he was concerned, a creamery erected in an area lacking sufficient business could set the industry back five years.[9] This balanced and rational approach to growth set his contribution apart from the others.

Wilson's attitudes to livestock encouragement continued virtually unchanged during his 1906-7 tenure as Saskatchewan's Dairy Commissioner. Once again he stressed that a high quality produce would stimulate the industry's growth. In 1912 he suggested farmers producing high grade cream be rewarded with bonuses,[10] since higher quality butter could only serve to upgrade the province's reputation in Canadian markets. At the same time his awareness problems in the industry increased and he warned that until labour shortages and high lumber costs were reversed dairying would suffer.[11] It would seem, then, that as an exponent of animal husbandry, Wilson's approach had been subdued but realistic.

Offering a wide assortment of arguments Rutherford, Motherwell, and Wilson all advocated the cause of animal husbandry. Utilizing approaches ranging from Rutherford's hyperbole and Motherwell's economic justification to Wilson's subtleties, livestock proponents urged grain growers to engage in stock raising. The failure of Saskatchewan's livestock industry to equal the importance of wheat growing cannot be attributed to them.

The Agricultural Press and Mixed Farming

Mixed farming received substantial support from the agricultural press. Specialized journals such as the *Nor'-West Farmer* and the *Saskatchewan Farmer* sprang up to promote farm diversification. Other journals such as the *Grain Growers' Guide* followed them into the fray. By promoting mixed farming as an alternative, the farm press sought to prevent the Prairies from opting for a wheat economy. Then, with the triumph of wheat during 1911-25, the agricultural journals campaigned to reverse the trend by outlining the folly of single-crop cultivation. For a five-decade period farm journals provided consistent support to the concept of animal husbandry.

The only significant farm journal in prairie agriculture's early years, the *Nor'-West Farmer* appeared as a mixed-farming advocate at the outset. Still carrying the early eastern influence of its editors, the *Farmer* first published articles treating dairy and beef cattle with as much importance as potatoes, corn and buckwheat. It was felt that a number of Ontario's mixed-farming techniques could be transferred to the Canadian Plains. Certainly, farms containing livestock in both Southern Ontario and Saskatchewan produced marketable products regardless of the weather. Moreover, an equal year-round work-load distribution enabled the mixed farmer to hire needed labour at economical rates rather than pay the high cost for harvest help.[12] Later, in a front-page editorial, S.A. Bedford, Superintendent of the Dominion Experimental Farm at Brandon, suggested that the steady year-round income derived from livestock rearing would free the farmer from the clutches of the moneylender. An additional benefit lay in crop rotation improvement. The soil-depleting rotation pattern of wheat, oats and fallow could be replaced with one involving the use of a leguminous fodder crop.[13]

The promotion of sheep husbandry became one of the *Nor'-West Farmer*'s favourite subjects. Sheep not only lent themselves to prairie agriculture because of their valuable meat, but added to the husbandman's profit by supplying wool, a necessity for the cold northwest climate.[14] It was presumed that sheep growers would encounter few problems. The weather proved favourable "there being little rain, and no cold, sleety days in winter, such as are common in many countries, and which are so injurious." Plains grasses provided succulent feed, "stock of all kinds quickly [fattening] on it."[15] Above all, sheep wintering was simple. No matter how inexpensive, a basic shelter would suffice as long as it could be kept dry.[16] Only wolves and dogs threatened farmers' stocks and it was thought that adding several bell-equipped goats to each herd would solve this problem.[17] With few disadvantages sheep husbandry ranked as a proposed mainstay to the dry-belt livestock industry.

Hog-rearing was also recommended by the *Nor'-West Farmer* but not with the same enthusiasm. Swine proved suitable for prairie production because their market value fluctuated less wildly than wheat and the potential for profit was constant: "Even with the prospect of a good yield of choice wheat, it is not going too far to allege that on an average of years and prices pork raising is a much surer thing than the best Red Fife to pin a farmer's faith to."[18] Hogs also solved a problem encountered by most grain growers by disposing of unmarketable grain. In May 1893 Edwin J. Brooks of Qu'Appelle reported that swine fattened well on smutty, frozen wheat.[19] However, this optimism was tempered with certain rules that required adherence if farmers hoped to achieve success. They were urged to acquire hogs in autumn and time their breeding so that offspring would appear in February or March. Proper shelter and pasturage would be necessary for the farmer to market mature swine the following November.[20] The *Nor'-West Farmer* warned of the wastefulness in attempting to fatten hogs in winter. Climatic factors virtually ruled against any chance of success. Swine husbandry, therefore, could become an asset only if husbandmen understood its limitations.

The only line of stock rearing that received the unanimous encouragement of the entire early agricultural press was beef and dairy cattle husbandry. Essentially every farmer commencing prairie operations could choose one of two paths - grain growing or mixed farming. While the former often result in "serious disappointments and embarrassments," mixed farming with an emphasis on dairying and cattle raising would always prove profitable. The prairie environment lent itself admirably to large cattle raising. In summer, cool prairie nights coupled with succulent grasses led, the *Nor'-West Farmer* boasted, to an incomparable quality of butter and cheese.[21] Meanwhile, beef cattle thrived in winter. Breeding presented few problems. In simple log shelters Shorthorn purebreds could procreate "with as much certainty of health and perfect development as in the closest pastures of England or Illinois, and at very much less expense for food and house room." Although they would consume greater quantities of feed in the process, Shorthorn cattle could even be wintered outdoors.[22] Thus, in the view of its early proponents, a glorious future awaited the mixed farmer.

By 1910 the agricultural press was forced to change its tactics as wheat triumphed in the market. Unlike the earlier period when livestock rearing was offered as an alternative to grain growing on an unsettled prairie, agricultural journals now suggested farm diversification as a means for counteracting grain price dips. Merely condemning the single-crop wheat economy would not suffice. Settlement had eliminated the natural prairie grasses which earlier mixed-farming exponents found so suitable as forage. Even simple cost-benefit analysis could show that mixed farming had begun to lose its assumed advantages. Louder and stronger than ever, farm journal exhortations continued to fall on unreceptive ears, yet the supposed weaknesses in the single-crop economy led farm journals to continue propounding mixed farming's tenets. Criticizing continuous wheat growing as being conducive to soil depletion and ultimately less profitable than animal husbandry, the *Nor'-West Farmer* argument secured[23] the support of other agricultural journals. Only the *Grain Growers' Guide* exhibited an initial reluctance to join the diversified farming bandwagon. In an outrageously titled article in 1914, "Wheat Growing a Crime," this journal of presumed agricultural reform described the mixed-farming movement as an eastern Canadian plot to divert grain growers' attention from a real grievance - the high protective tariff! Defending wheat cultivation for its role in transforming the Prairies into "the British Empire's Granary," the *Guide* added that this crop had provided the stimulus for the construction of Canada's railroads and agricultural implement factories.[24] Even the *Guide* was ambivalent, however, and the effect of this article was somewhat mollified by a piece in the same issue outlining Saskatchewan's bright, mixed-farming future.[25] When the *Nor'-West Farmer* nailed its "colors to the [mixed farming] masthead,"[26] the other agricultural journals tended to follow. Livestock industry encouragement virtually became a motherhood issue with the popular press.

Farm journals launched a two-pronged campaign to encourage swine and sheep husbandry with profitability as the cornerstone. The *Nor'-West Farmer* declared that "it [was] much the same way in sheep and hogs. There [was] money for the average farmer in raising both these crops." Even utilizing valuable acreages proved no deterrent. The *Farmer* asked:

> if raising pigs for $7.25 or $7.50 market spells financial loss to the farmer on $30 or $40 lands, how do the Ontario farmers and the Iowa farmers build new barns and send their sons to the agricultural college out of the profit of hogs raised on much clearer land at the considerably lower prices at which these men sell their hogs right along?[27]

Moreover, while hog raising complemented dairying by consuming many waste products, sheep rearing provided a similar service to grain growers. Eating not only unmarketable wheat, sheep could convert elevator grain screenings into profit.[28] Extolling the virtues of sheep rearing the agricultural press in its zeal even supplied misinformation. Ignoring the fact that the farmer-operated disc or cultivator could perform the task with equal efficiency, the *Saskatchewan Farmer* boasted that sheep eradicated noxious weeds more effectively than any other means.[29] The farm press did not conceal the investments necessary for successful animal husbandry. Intimating that brome grass and alfalfa should form part of a sheep's diet, the *Nor'-West Farmer* did not consider the expenditure as a restraining factor. Even fencing and housing posed few problems. The required expenses for sheds, watering places, and fences would be readily offset when the finished produce was marketed.[30] Hog and sheep raising could only prove beneficial.

The prospect of steady profits, of money jangling in stockmen's pockets, constituted the sole ground on which farm periodicals lured farmers to engage in cattle rearing. Unlike wheat prices which seldom remained constant, beef and dairy returns supposedly wavered little. In eastern Canada where milk sold for less than on the Prairies, the dairy industry thrived. Surely, the *Saskatchewan Farmer* predicted, the West with its abundant pasturage could market dairy products that would enrich its producers.[31] The *Grain Growers' Guide* held similar hopes for beef cattle. Abatoirs in Toronto, Montreal and Winnipeg eagerly awaited shipments of western beef cattle. In return they paid farmers attractive sums.[32] The *Nor'-West Farmer* assessed the situation closer to home. Saskatchewan cows were needed in Winnipeg for conversion into "many juicy tenderloin, sirloin and porterhouse steaks, the kind that appear on cafe bills of fare at $1.25 to $1.75 per [serving]."[33] Failing to mention the overhead involved in constructing barns and silos and cultivating forage crops, farm journals hoped that profit predictions would serve as a sufficient motivating force.

Throughout 1880 to 1925 the agricultural press appealed persistently for farm diversification. Initially viewing livestock rearing as a viable alternative to grain growing during the 1880s, farm journalists adopted new arguments after wheat's triumph. Insofar as their objective was concerned, the agricultural press had failed. But factors unrelated to journalistic prowess nullified the mixed-farming movement's effectiveness.

Role of the Dominion Government

The Dominion government failed to participate fully in the farm diversification campaign in the period. Expending little effort to assist prairie animal husbandry financially and morally, the Department of Agriculture geared its program towards encouraging grain production. In no area was this more evident than on Dominion Experimental Farms. While basking in the glory of their grain-growing achievements, superintendents of Brandon and Indian Head research facilities reported few livestock experiments. A similar situation existed in the lack of bulletins and circulars pertaining to prairie animal industry conditions. Virtually all instructional pamphlets before 1921 assisted the eastern Canadian stockman in coping with his peculiar situation. Government financial aid to livestock education can only be described as non-existent during the period. Refusing even to entertain the thought of encouraging prairie swine, sheep and poultry husbandry on the Prairies, the Department of Agriculture liberally donated funds to encourage these same industries in Canada's other regions. With W.R. Motherwell's appointment as Minister of Agriculture the dry belt received greater attention, but assistance came too late. Federal government inaction restrained the industry's growth.

Research conducted at the Indian Head and Brandon Experimental Stations before 1925 took scant notice of animal husbandry. Consisting primarily of feeding tests, the work the firms did undertake left unresolved the problems involved in livestock breeding and housing. Conducted thoroughly, the feeding tests determined the most practical ratios for cattle and swine. Yet federal government refusal to explore the remaining problems of livestock rearing could be construed by potential stockmen as implying that mixed farming was risky.

Conducted mainly under the auspices of Angus MacKay at Indian Head and S.A. Bedford in Brandon, tests determined suitable types and quantities of cattle, sheep and hog feeds. Commencing with a simple hay versus hay and ensilage steer rationing comparison at Indian Head in 1894,[34] experiments became markedly more complex over the years. A decade later Brandon agriculturalists contrasted the weight of cattle fattened on corn with those on brome hay, both diets being supplemented with turnips, chop and bran.[35] The experiments were not confined to cattle. Commencing with basic comparative grain diets in 1895, swine received such succulent delicacies as skim milk, mangels and potatoes by 1907.[36] Even sheep received their share of attention. At one point the Brandon farm completed a detailed comparison pitting alfalfa and hay as adversaries.[37] Yet, experimental farm accomplishments remained minimal. A knowledge of suitable feeds would certainly assist the stockman in his daily routine. The absence of experimentation in animal breeding and housing retarded the mixed-farming promotional campaign.

Early federal publications seldom dealt with prairie conditions. The only statement that J.B. Spencer, a specialist in animal-rearing techniques, could muster in a bulletin devoted to beef cattle concerned the severity of the prairie climate. Stating that "the injury to the health and vitality of our domestic animals through ill-ventilated and badly lighted [sic] stone basement barns of the older provinces is intensified a hundredfold in this climate," these observations marked the extent of his analysis.[38] By guilt of omission the Department of Agriculture similarly neglected prairie sheep and swine raising. Instructional circulars published in 1916 delved so generally into their topics that prairie peculiarities received no consideration.[39] Even instructional guides for silos neglected the Prairies. An early bulletin on stave silo construction failed to discuss the design's feasibility for usage in the Northwest.[40]

Although the Department proudly boasted in its annual reports that the Livestock Branch supplied lecturers for provincial extension courses, the overall contribution was negligible. A total of seven speakers giving only occasional talks could hardly provide the impetus for farm diversification in Saskatchewan and Alberta in 1905.[41] Nine years later the numbers were so minimal that the Department refused to publish statistics.[42] Only sheep husbandry received some form of useful help. Confined to Alberta it took the form of several instructional exhibitions on wool grading and marketing.[43] Yet other regions could count on a more intensive government effort. Martin Burrell, the federal Minister of Agriculture, wrote W.F. McDonald, Secretary of the British Columbia Stock Breeders Association, that "in deciding to do something to stimulate and assist the sheep industry we selected the Maritime Provinces and British Columbia for assistance first."[44] The government's preoccupation with other matters was obvious.

With the approach of the century's second decade a shift in government agricultural policy took place. Well-funded Livestock Branch programmes now provided incentives for dry-belt livestock rearing. Refusing to acknowledge responsibility for the industry's unhealthiness, the Livestock Branch blamed the Western Canada Livestock Union, the prairie stockmen's association. Describing plains animal rearing as a sorry mess, H.S. Arkell, Dominion Livestock Commissioner, suggested that "if the Union is to continue to command public confidence" it should find "ways and means by which the average farmer's revenue can be so increased as to enable him to make a more comfortable living."[45] The unwarranted speeches that Arkell accused the Union of providing merely reflected past government policy; before 1920 the Livestock Branch had followed the same course, even though with so few lecturers in the field orations were delivered only occasionally. Nevertheless, the federal government tried to rectify its past mistakes by embarking on a sensible course.

Incentives to increase livestock production were numerous. To encourage improved cattle breeding the government purchased pure-bred bulls, reselling them to stockmen at cost price plus freight. In areas with a high demand the Livestock Branch provided stables to assemble the sought-after stock.[46] Another programme permitted prairie buyers to visit Edmonton and Calgary stockyards at government expense to acquire breeding animals. To be reimbursed for travel, hotels and meals, the farmer agreed to keep his purchases for one year. As an added inducement the government even offered to pay freight charges from stockyard to farm.[47] Other aspects of the livestock industry received support. To encourage sheep and hog raising the federal government dispatched Better Farming Trains on prairie itineraries. The Livestock Branch supplied live exhibits of ideal bacon hogs and wool-producing sheep for exhibition purposes.[48] Provisions were made for the inclusion of sheep. C.W. MacRea, Acting Livestock Commissioner, "proposed that the Branch provide two pure-bred rams of good type, two scrub ewes, and two ewes, the progeny of pure-bred rams, to demonstrate the influence of the pure-bred sire on the flock."[49]

One notable exception to the federal government's attitude of neglect was its role in subsidizing North-West Territories' creameries between 1895 and 1906. A Saskatchewan economist, Gordon C. Church, provides a plausible explanation for this seemingly peculiar undertaking. Asserting that the effectiveness of Canada's national policy depended on the country's ability to export its products and attract immigrants, he believed that federal officials considered a viable dairy industry a prerequisite for future prosperity. As a means of enriching farmers and precipitating inflows of foreign funds, Sir. John A. Macdonald equated the industry's success with Canada's emergence as a major exporter.[50] Since dairying formed the basis for eastern Canadian agricultural prosperity and intensive wheat growing remained untried, the federal government hoped that by emulating Ontario agricultural practices on the Prairies Canada would benefit. Moreover, mixed farming would attract emigrants - Europeans who supposedly preferred the mixed farming of their homelands to the new grain-growing techniques. By 1906 the unexpected success of prairie grain growing led to a waning of federal government interest in the dairy industry. But during the preceding years thousands of dollars had been expended on the behalf of dairying.

Meticulous organizational detail characterized federal involvement in dairying. Deciding "that a full fledged attempt to establish the factory system in the dairy industry on the western plains would be successful," in 1897 Canada's Dairy Commissioner opted for a comprehensive programme of Dominion assistance to creamery oper Church describes the plan as follows:

> A loan was to be made to a joint stock company of farmers or a butter and cheese manufacturing association sufficient to provide the equipment for a creamery, or creameries, or skimming stations. The company or association, which was to be duly incorporated was to provide suitable buildings and an adequate water supply. The way in which the buildings were to be erected and equipped and the site of these buildings were to be subject to the approval of the Department of Agriculture. The company, or association, was to guarantee a supply of milk from at least four hundred cows. The government was to manage the creamery, manufacture and market the butter and make advance payments to the patrons of the creamery on the basis of two-thirds of the estimated net value of the milk and cream supplied by each. The government's manufacturing charge was to be four cents per pound of butter manufactured and not less than one cent per pound of butter over and above the manufacturing charge was to be taken by the government to be placed in a loan fund to repay the government loan or to pay debts due on buildings and premises. Government control was to continue for at least three years unless the loan was repaid before that time and the company or association desired to take over control.[51]

The plan demonstrated the Department of Agriculture's earnest desire to firmly establish prairie dairying.

Extensive in scope the dairy assistance scheme proved ineffectual. Initially the Dairy Branch granted aid to 16 creameries including nine that had been in operation before the plan's 1897 implementation date.[52] By 1901, 19 creameries were operational in the North-West Territories, 11 being located in the future province of Saskatchewan. But as the wheat economy established its foothold, the farmer's initial interest in dairying waned. Canada's Dairy Commissioner, J.A. Ruddick, reported that only four creameries functioned in Saskatchewan in 1905. The financial position of Saskatchewan's creameries was precarious. From a total of $8536.47 advanced to Maple Creek, Moosomin, Qu'Appelle and Wolseley facilities, $3352.46 remained unrepaid. Ruddick claimed that "if the support which the Moosomin and Qu'Appelle creameries have received from the Government should be withdrawn, it is doubtful if their operation could be continued."[53] His observation underlined the failure of the dairy industry to become self-sustaining.

American attempts at encouraging animal husbandry differed sharply from Canadian efforts. State control over experimental stations along

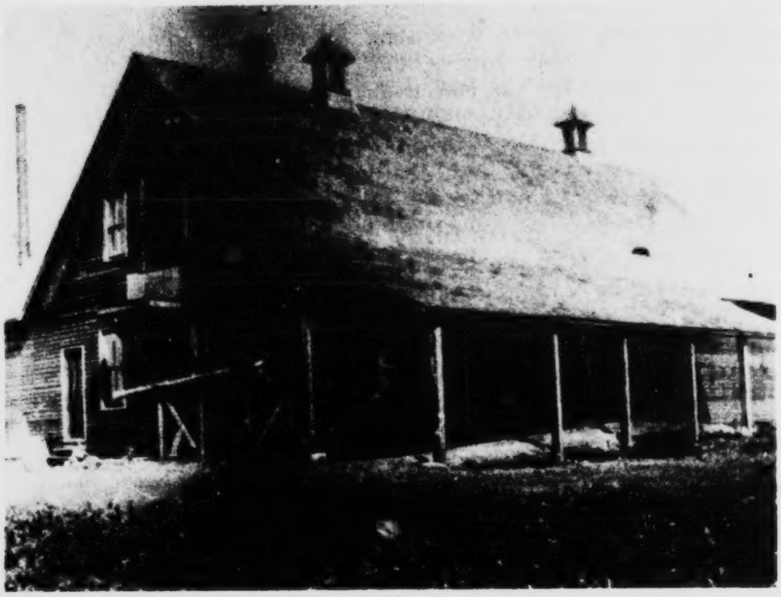

Figure 2. The creamery at Innisfail, Alberta, 1901. (Glenbow-Alberta Institute, Calgary.)

Figure 3. Interior of a city dairy manufacturing plant before 1920. (Saskatchewan Archives Photograph.)

with a greater awareness of the need for farm diversification enabled the border states of Montana and North Dakota to launch livestock promotional campaigns more effectively than their Canadian counterparts. State programmes touched on many areas that Dominion Experimental Farm authorities ignored.

Montana and North Dakota undertook a greater variety of experiments than the Brandon and Indian Head farms. Commencing with a series of hog, sheep and dairy cattle feeding tests,[54] state agriculturalists carried their efforts into other areas. Investigations into hog production touched on such topics as breeding, wintering, disease control and marketing.[55] Even the draft horse received attention. North Dakota investigators determined the exact amounts and preferred types of rations suitable for Clydesdales and Percherons under various working conditions.[56] Relying on their experimental farms to provide answers to a series of problems, not merely one, American farmers had added incentive to enter the field of animal husbandry.

Oriented to a greater degree to local conditions as a result of the state-controlled experimental stations, Montana and North Dakota bulletins contained information of greater relevance to prospective stockmen than Ottawa publications. Beginning in 1894 when Luther Foster wrote that "the past year has made the farmers of the state [Montana] realize more than ever before, the necessity of greater diversity in farm products" by "concentrating the product [sic] of the farm into pork, beef, and butter,"[57] states continued to publish tracts that would encourage mixed farming. Like the experiments, publications advanced far beyond cattle-, sheep- and hog-raising techniques. Most notable were treatises on barn construction, silage preparation and poultry management. A North Dakota pamphlet provided precise information on the attributes and disadvantages of various shelters under prairie conditions.[58] A Montana silage essay instructed husbandmen on the clover and corn fermentation process.[59] Montana and North Dakota publications thus covered greater ground than their Ottawa counterparts. On the whole, American experimental stations undertook a programme designed to encourage farm diversification, measures Ottawa should have emulated.

Beyond the few initiatives taken by the dominion government, the Saskatchewan government involved itself in the promotion of animal husbandry. Before the end of World War I the Department of Agriculture strongly advocated farm diversification but limited its assistance to one campaign providing better breeding stock and a number of educational programmes. During the 1920s expanded schemes for livestock improvement accompanied the government's efforts at moral suasion. By the decade's midpoint, however, the government's programmes had achieved only marginal success.

Role of the Saskatchewan Government

To justify its stance in favour of farm diversification during 1906-25, the Saskatchewan Department of Agriculture espoused arguments similar to those found in the agricultural press. Leading governmental agriculturalists spoke and wrote about the profitability of livestock and its value in converting grain's by-products into cash. Dominant in government thinking was the profit motive. Beginning with an appeal by W.R. Motherwell in 1907, animal husbandry's raison d'être became that of monetary returns. According to the Commissioner of Agriculture, mixed farming would negate the gamble involved in exclusive wheat cultivation.[60] Others echoed Motherwell's sentiments. Applying the profit motive to horse breeding, a leading authority wrote that horses "are one of the most profitable lines of farm production, more especially so in view of the high prices that prevail now [1907] and are likely to for some years."[61] Even dairying's key advantage lay in its ability to provide constant returns. In 1919, R.E. Reed, Saskatchewan's Dairy Commissioner, asserted that 99 out of every 100 farmers following this call considered profit the industry's only attraction.[62] Yet the government cited other factors in justifying its stance. At a major Saskatchewan conference an internationally known agriculturalist declared that animal industry's value lay in the ability to consume grain growing's waste products. Asserting that "grain will always form an important cash crop for the dry farm" he added that "livestock should be used to market the crops that must necessarily be grown to get and maintain the highest production of grain on the dry land and also to utilize to the fullest extent the by-products of the grain crop."[63] When appeals to profitability and efficiency failed, the trump card of patriotism was laid. In 1918 Motherwell asserted to a select audience that skillful propaganda outlining the dangers of starvation to Canada's French and Italian allies would spur Saskatchewan hog producers in spite of high overhead costs.[64] In short, the Saskatchewan government appealed to farmers with arguments common to the agricultural diversification movement.

Before the establishment of the Saskatchewan College of Agriculture in 1910 the government took responsibility for the province's agricultural extension programmes. Lectures on grain growing generally exceeded those provided for animal husbandry. Surprisingly, activities in 1907, the first year of governmental involvement, laid heavy stress on animal husbandry. A bevy of unknown agriculturalists dwelled on topics such as profitable horse raising, beef cattle breeding and dairy cow testing. Ten of 14 departmental lectures specialized in livestock topics.[65] The programme experienced a dramatic reversal the following year. Animal husbandry lectures became less oriented to specific problems and laid greater stress on general industry promotion. Speakers addressed audiences on such vague subjects as "Breeding, Feeding, and Livestock Management." During 1908 only 7 of the department's 15 lecturers demonstrated expertise in animal husbandry.[66] By 1909 the government had committed itself to educating the grain grower at the stockman's expense. The department limited its efforts to exhortations in favour of stock rearing. Only 6 of 15 extension workers delivered livestock-related lectures.[67] Clearly, with the exception of 1907 operations, the Department of Agriculture considered grain-growing education a greater priority.

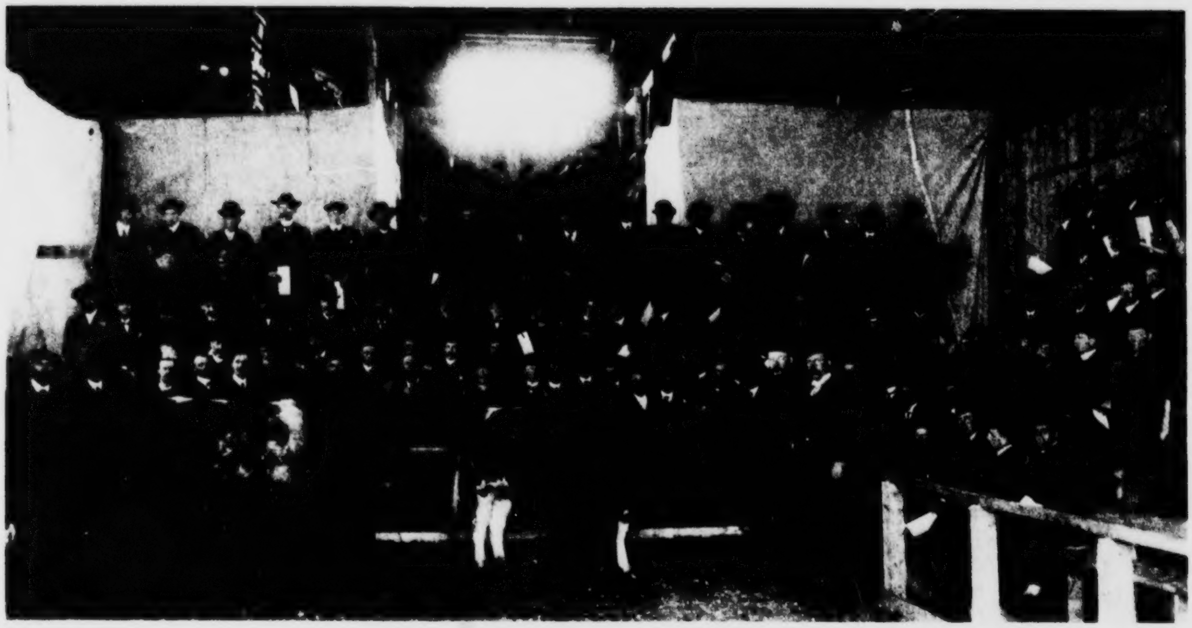

Figure 4. Cattle judging show at Regina, 1905. (Saskatchewan Archives Photograph.)

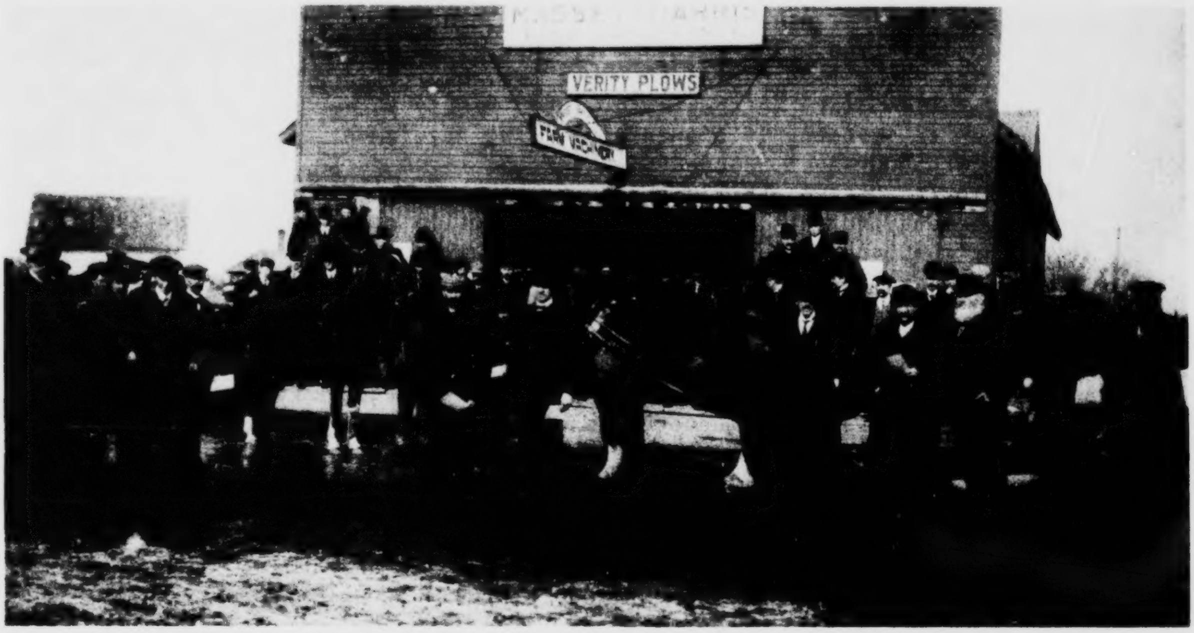
VERITY PLOWS
FARM MACHINERY

Figure 5. Stock-judging school, Prince Albert, Saskatchewan, February 1905. (Saskatchewan Archives Photograph.)

A major undertaking to encourage animal husbandry lay in the provincial government's decision to despatch Better Farming Trains to rural points. Although devoted to all forms of agriculture, several railroad cars on each train boasted livestock displays. During the programme's 1914-18 heyday, trains containing at least one livestock viewing car, one coach devoted to farm plans, and offering animal judging exhibitions travelled to most provincial locations.[68] The Department also made arrangements for lectures on livestock topics.[69] Despite travelling over 2000 miles and stopping at 133 towns alone in 1914,[70] the trains cannot be considered successful. Authorities provided no displays outlining the advantages of utilizing high quality breeding stock. Moreover, dairying displays failed to illustrate methods for upgrading the province's butter. The programme failed so miserably in its attempt to encourage animal husbandry that K.G. MacKay, a leading dairyist, considered resigning.[71] More comprehensive displays aboard Better Farming Trains would have to await the 1920s.

The only pre-1919 scheme to achieve success was a breeding stock subsidization plan. Although failing to obtain the needed education on breeding stock that Better Farming Trains could impart, stockmen benefited from the government's plan to distribute sheep and cattle. Passage of the Livestock Purchase and Sale Act during the 1913 legislative session signalled the programme's introduction. Setting aside $250,000 annually for the purchase of animals, the Department of Agriculture re-sold stock to bona fide Saskatchewan farmers holding memberships in farm organizations. The scheme applied principally to cattle. Grade females could be purchased with a 25 per cent down payment. Farmers intending to raise pure-bred stock paid cash for their acquisitions. The government distributed sheep in autumn when wool sales would be expected to cover the required deposit. From a numerical viewpoint the programme proved highly successful. During the September to November 1916 span alone, the government sold 6174 cattle. A total of 5000 sheep reached Saskatchewan farms during 1913-1916.[72] Unlike other Saskatchewan government livestock encouragement projects, the animal distribution plan proved effective.

The most apparent improvement in the government's livestock promotional campaign during the 1920s lay in upgrading Better Farming Trains. Aware of past shortcomings, officials sought to improve these mobile exhibitions by increasing their size, providing more detailed displays, and selling demonstration stock. As early as 1920 farmers reaped benefits. The Better Farming Train of that year could boast a total of three cars, all devoted to displays of high quality dairy and beef cattle, draft horses, hogs and sheep.[73] Better Bull and Better Livestock Trains soon implemented those devoted to general farming, eventually surpassing the latter in importance. In 1921 a Better Bull Train visited 21 towns and reached 5000 people. The following year a similar train made 58 stops and attracted 15,700 citizens. Featuring several carloads of bulls as well as dairy cattle and hogs, Better Bull Trains offered farmers the opportunity to purchase suitable breeding stock at realistic prices.[74] The ultimate refinement, the Better Livestock Train began operations in 1925. Consisting of 19 cars, several devoted to specific cattle breeds, this livestock show on wheels also included swine, sheep and poultry exhibits. A feature farmers undoubtedly appreciated was the lecture car. In each town husbandmen would be treated to speeches on fodder crops, livestock feeding, dairying, and bacon hog production. Officials even made provisions for farmers wishing to trade on the train's itinerary.[75] Clearly demonstration trains had evolved from mere curiosities to mobile displays geared to encouraging and improving Saskatchewan's livestock industry.

The Saskatchewan government undertook a number of ancillary measures to stimulate animal husbandry. Conferences and better bull campaigns constituted two of the more important means devised. Livestock conferences became popular during the 1920s recession. Unlike agricultural society meetings which considered all matters pertaining to husbandry, this new variation stressed livestock topics in general and on occasion dealt with only one line of animal rearing. Perhaps the most important meeting of its type was the livestock assembly held at the University of Saskatchewan in March 1922. Bringing together such leading industry advocates as J.H. Grisdale, H.S. Arkell and W.R. Motherwell,[76] the Saskatchewan organizers hoped that conference deliberations would lend credence to provincial undertakings. Centred on the theme of "making a living out of cattle," the meeting's objectives lay in outlining livestock's monetary advantages over grain growing.[77]

The Better Bull Campaign received equal government treatment. Having commenced with a cattle distribution scheme in 1913 the programme took a new direction in 1922. Farmers now received circulars "showing a list of breeding having pure bred bulls for sale, giving particulars regarding breed, name and number of bull, age, weight, colour and price." Aimed primarily at owners of inferior breeding stock, the Department hoped the advertisements would whet their appetite for acquiring superior males.[78] By convincing others to assert their programmes' respectability and by rectifying the perennial problem of inferior breeding stock, the Saskatchewan government had made an earnest effort on animal husbandry's behalf.

The effectiveness of the Saskatchewan government as a farm diversification promoter during 1906-25 was limited. Post-1919 policies such as Better Bull and Better Livestock Trains made great strides in convincing husbandmen of the assets of livestock rearing. Unfortunately 5 years work could not negate 15 years of neglect. Agricultural schools generally and the Saskatchewan College of Agriculture in particular constitute the last of the major animal-husbandry proponents. Providing extensive training in livestock management as part of its regular curriculum, aiding in extension schemes, and conducting breeding and feeding experiments, the provincial college in Saskatoon arose as one of the dry belt's leading stock-raising promoters. Travelling the road charted by the Ontario Agricultural College, prairie schools adopted eastern Canadian programmes in their entirety.

Role of the Saskatchewan Agricultural College

The Saskatchewan Agricultural College's animal husbandry activities can be directly traced from Ontario origins. As early as 1881 the Ontario Agricultural College in Guelph offered compulsory first-year training in horse, cattle, sheep and swine rearing. Second-year lectures on stock feeding and dairying completed the student's orientation.[79] By 1904 the O.A.C. precedent had been set. Besides offering courses in dairy and animal husbandry, professorial staff lectured at agricultural institute meetings and served as livestock judges at county fairs. Moreover, leading husbandmen conducted cheese making, swine feeding, and pasturing investigations.[80] Soon after its establishment in 1910, the Saskatchewan Agricultural College began performing the same three functions.

Shortly after its establishment, the Saskatchewan Agricultural College began disseminating livestock information to its student body. In animal husbandry courses first-year pupils received instruction in animal anatomy and physiology. The succeeding year they could expect lectures on the origin and history of livestock breeds. As a student advanced, courses increased in complexity. Professors indoctrinated third-year students in western animal breeding and management while those choosing to take a fourth year studied advanced breeding.[81] The College laid equal stress on dairying. Offered both to freshmen and sophomores, courses emphasized such topics as cream pasteurization. By 1924 skilled and highly competent dairy specialists, determined to improve provincial creamery operations had graduated from the Saskatoon campus.[82] Even Veterinary Science received its share of attention. With the introduction of courses during the early 1920s, students could select first- and second-year programmes touching causes, symptoms and prevention of livestock diseases in the province. Professors even went to the extent of offering a course "featuring obstetrics....dealing with hygiene of the pregnant animal.....the handling of the pregmant animal in parturition and the common diseases occurring as a result of parturition."[83] The college's livestock offerings obviously covered every aspect of the industry.

The Saskatchewan Agricultural College participated fully in extension work. Animal husbandry lecturing at various rural points and livestock judging at regional fairs constituted major activities. Farm lectures were numerous. In 1916 the Animal Husbandry Department reported that speakers had been supplied for the Better Farming Train. During the same year departmental members spoke at the Provincial Dairymen's and Provincial Livestock Conventions.[84] With the approach of the 1920s, professional agriculturalists continued with their oratorical endeavours. In 1924 the same department boasted of speeches it provided to various farm conventions and meetings at Maple Creek, Conquest, Bounty, Penticton, British Columbia and Bozeman, Montana.[85] Stock judging supplemented the disquisitions. Animal Husbandry departmental staff evaluated livestock at fairs in Regina, Saskatoon and Brandon in 1916.[86] The Dairy Department claimed credit for judging dairy products at three summer fairs the following year.[87] By 1924 work had progressed even further. A.M. Shaw, head of Animal Husbandry at the college, asserted that his staff provided services for six livestock shows.[88] Such extensive lecturing and judging could only contribute to the livestock promotional effort.

Livestock experimentation constituted a third area where the agricultual college became involved. Despite a late World War I start for most investigations, by 1925 considerable progress had been made. Animal husbandry queries can be dated to 1916. Attempting to resolve animal-breeding problems, one test discerned the effects of mating pure-bred rams with "scrub" sheep. Another tabulated the cost of raising swine from birth.[89] Eight years later livestock investigations had been expanded greatly. Agriculturalists compared the suitability of sunflower, corn and sweet clover silage as dairy cattle feed. Extensive hog-feeding trials considered the effect of diet and shelter on animal growth. Even horses received departmental scrutiny. Leading agriculturalists raised questions concerning the wisdom of working female horses before and after pregnancy. They even sought information on the maternal influence of the offspring's growth and development.[90] The Dairy Department also contributed its share to the research effort. Attracting attention in 1922 were such topics as the effect of pasteurization on butter flavour and the impact of pasteurization's high temperature on butter's ability to retain freshness.[91] Several years later the department co-operated with the federal government in a study of butter contamination. Saskatoon's City Health Officer could also rely on the college for testing the purity of cream, butter or milk.[92] By the mid-1920s it became apparent that college-conducted experiments touched on areas neglected by other livestock proponents.

Thoroughness was the hallmark of the Saskatchewan Agricultural College's educational effort. The totality of its regular livestock educational curriculum, extension activities, and experimental efforts place the institution as one of the prairie's leading animal-husbandry proponents.

Conclusion

A number of individuals and organizations had tried valiantly to convince prairie farmers to diversify. John Gunion Rutherford, William R. Motherwell and W.A. Wilson entered the fray wholeheartedly. The leading press proponent, the *Nor'-West Farmer*, advocated animal husbandry staunchly from its 1880s beginning. Joined by the *Saskatchewan Farmer* in 1910 the two periodicals had published a barrage of mixed-farming propaganda. But despite individual and journalistic efforts as well as those of the Saskatchewan Agricultural College, the educational campaign achieved only partial success. Shunning the movement until the post-war recession, federal and provincial governments failed to provide the early legitimacy which farm diversification so urgently required. Lack of initial governmental enthusiasm signalled the death knell for any hopes husbandry proponents may have entertained of posing livestock rearing as a practical alternative to grain growing.

THE EXTENT OF VETERINARY SCIENCE AND ANIMAL HUSBANDRY ADVANCES, 1880-1925

The years 1880-1925 saw significant progress in the veterinary sciences, with the result that the common livestock diseases were nearly eliminated. The federal government assisted scientists by introducing and developing animal inspection and quarantine procedures. Husbandmen also benefited from developments in the practice of animal rearing, especially improvements in breeding and dairying. Yet a nagging problem remained unresolved - the elimination of dampness in cattle, sheep, hog and poultry shelters during the long winters. As late as 1920 the gap in barn architecture made animal husbandry as risky a business as grain growing instead of providing the advertised insurance.

The Ontario Veterinary College

In the vanguard of early veterinary advancements stood the Ontario Veterinary College. Instructing students in the profession's principles as well as in diagnosis and routine surgery, the Toronto institution became Canada's leading supplier of practitioners. A westward migration of several leading graduates paved the way for the profession's prairie development and subsequent efforts to eliminate diseases prevalent on the Plains.

Andrew Smith, a Woodstock veterinarian, established the Ontario Veterinary College as a private venture in 1864. Receiving no governmental assistance, the school relied on tuition fees to cover operational costs. To survive, the College set low educational standards. Virtually all applicants secured admittance to its programme. Moreover, studies could be completed in a short period. Steeping himself in such basic subjects as disease and treatment, breeding and feeding animals, physiology, chemistry and medical materials, the ambitious student could acquire a rudimentary knowledge of his profession within one year. The school remained under Smith's tutelage until 1908 when the Ontario government purchased it. Despite its shortcomings, about 200 veterinarians graduated yearly from the college from 1866 to 1908. Three thousand strong and constituting the majority of Canada's veterinary surgeons in 1908, O.V.C. graduates could acclaim Andrew Smith as the father of Canadian veterinary science.[1]

The Ontario government takeover ushered in a new phase of educational upgrading. Entrance requirements were tightened to encompass basic literacy. A three-year programme with voluminous course offerings now awaited prospective applicants. Beginning in 1908 all students received training in veterinary principles, materials and surgical procedures as well as basic science courses in bacteriology, chemistry, zoology and botany. The College even provided education in milk and meat inspection, horse-shoeing, and veterinary dentistry to prepare pupils for future employment.[2] The curriculum received further enlargement during the century's second decade. Veterinary pathology, concentrating on the study of tumors, cysts, and bore diseases in livestock, was taught over two years. The institution's professorial staff supplied lectures on veterinary obstetrics and parasitology - two fields in which scientific advances warranted dissemination of new knowledge.[3] By the time Manning Doherty, Ontario's Minister of Agriculture, announced the College's re-location to the Ontario Agricultural Campus in Guelph in 1919,[4] the O.V.C. had established itself as a leading institution of higher learning.

Developments in Veterinary Science

Late 19th-century veterinarians made considerable headway in identifying and eliminating Canadian livestock disorders by utilizing the methodology of the science's founders. Robert Koch's discovery of bacteria revolutionized animal diagnosis. Tracing anthrax's cause to the multiplication of cell structures in cattle and sheep, Koch attributed tuberculosis and cholera to similar agents. Louis Pasteur continued in Koch's footsteps. Centering his attention on anthrax he developed a preventive technique - innoculating cattle with a mild form of the disease.[5] Surgical advances paralleled diagnostical achievements. A British surgeon, Lord Lister, perfected antiseptics for wound treatment and refined the veterinary excision process.[6] Canadian veterinarians applied these discoveries in daily examination and treatment of cattle, sheep and swine.

Great strides in 19th-century veterinary science were taken in cattle disease detection and elimination. Recognition obviously constituted the first priority. To determine a farm animal's ailment, Fred Torrance, a Manitoba veterinarian,[7] suggested that farmers or practitioners observe a number of bodily functions. The positioning and movement of cattle while resting could signal certain disorders. If abnormally slow, a cow's pulse could indicate inflammation in a number of organs. Undue nasal discharge might identify a pneumonia case.[8] Accurate detection could lead to ameliorative measures.

The complexity of cattle remedies indicated the extent to which veterinary science had progressed. Only one restorative can be described as questionable. To nullify the symptoms of blackleg, a disease caused by chills, a leading farm journal recommended that husbandmen innoculate infected stock with a solution comprised of garlic and turpentine. The effluvium emanating from the cow's nostrils and mouth would supposedly limit microbe expansion![9] Veterinarians devised a more practical cure for anthrax. Rather than undertake a costly innoculation programme to counteract this disease in which bacteria destroyed red corpuscles and curtailed breathing, J.G. Rutherford, an O.V.C. graduate, recommended preventive measures. Butchering and burning confirmed blackleg cases would stop the disease in its tracks.[10] Treatment for garget completed the list of late 19th-century bovine remedies. Confined to dairy cattle after calving, victims experienced hot, painful and swollen udders along with a reduced milk flow. To treat the condition Fred Torrance suggested that farmers drain the udder of its milk supply, by hand if possible, with a milking tube if necessary. Placing a poultice on the affected spot would complete treatment.[11] Nineteenth-century knowledge of cattle diseases and ameliorative processes would be improved in subsequent years.

Of prime concern to sheep husbandmen was a disease known as scab. Stemming from tiny almost microscopic insects which tunnelled under the cuticle producing intense irritation, this affliction caused the sheep's wool to fall off. Moreover, it spread quickly to infest entire flocks. Restless animals that constantly rubbed themselves against posts and scratched infected areas with hooves were prime candidates for an effective ameliorative - the dip. Immersing his stock in vats containing such poisonous chemicals as arsenic, sulphur, turpentine and mercurial ointment, the farmer soon witnessed an abatement in the disease's symptoms.[12]

Hog producers were less fortunate. The great killer, cholera, resisted all attempts at treatment. Marked by ulceration of the stomach and bowels, the infected pig displayed symptoms of fetid diarrhea, ardent thirst, and prostration. Veterinarians suggested that contaminated stock be butchered and buried deeply, and that all animals and facilities on the farm be disinfected thoroughly.[13] Nineteenth-century technology had certainly identified most livestock disorders, even if means for eradication still awaited discovery.

Far-reaching advances in cattle, sheep and swine treatment procedures marked the first two decades of the 20th century. Progress in veterinary science now enabled farmers to innoculate cattle against blackleg and cures for cattle abortion and milk fever were discovered. Sheep and hog diseases attracted scientific attention. While dipping improvements transformed sheep scab to a disorder of the past, innoculative techniques quickly eliminated the ravages of hog cholera. By 1920 veterinary achievements had negated the effects of most previously troublesome livestock maladies.

Bovine disorders received the concentrated attention of researchers. Veterinarians no longer presribed the ubiquitous and redolent garlic and turpentine injection as a blackleg remedy. As a preventive measure the blackleg vaccine stood supreme. Available as early as 1895 in the United States, the vaccine began to be used extensively in the Canadian Northwest six years later.[14] Practitioners found the innoculative procedure easy to perform. Inserting the needle under the cow's neck or inside the thigh, veterinarians treated livestock each spring. A full year's effectiveness for each injection made the process worthwhile.[15]

Scientists devised less spectacular but equally effective antidotes for contagious abortion and milk fever. Although its cause was unknown, observers discovered that bulls could spread contagious abortion from one cow to another when mated with a series of animals. Frequently, when abortion occurred it was only detected by a farmer stumbling across a dead foetus in his stable. A slight swelling of the udder and a soiled tail constituted other symptoms. Newly devised techniques enabled farmers to arrest the spread of this disease. The *Nor'-West Farmer* suggested that stockmen disinfect afflicted cows and guilty bulls by applying chemicals to their genitals.[16] The cure for milk fever was similarly effective. Occurring only among highly productive milch cows, victims exhibited symptoms consisting of an irregular milk flow and constipation. Eventually the animal became so weak that it could no longer stand on its feet. A simple analeptic alleviated the disorder entirely. An injection of air into the cow's udder destroyed the disease-causing bacteria. Veterinarians recommended that a specially designed milk fever apparatus be utilized although a common bicycle pump could be substituted. Exercising extreme caution the veterinarian could rectify 95 per cent of the cases.[17]

Sheep and swine received their share of trained attention. Refined dipping techniques virtually eliminated sheep scab. Animal-husbandry specialists streamlined the dipping process. Beginning with 30 gallons of water, 10 pounds of fresh lime, and 24 pounds of sulphur, the stockman boiled the contents for three hours. After allowing the mixture to cool the farmer supplied an additional 70 gallons of water. At a temperature varying from 106 to 112 degrees Fahrenheit, sheep were immersed for two minutes, the process conducted twice in a 10-12-day period.[18]

Simpler in nature, but more significant, was the cure for hog cholera. Traceable directly to certain germs that multiplied under unsanitary conditions, the disease could be controlled but not eliminated if the farmer observed rules of cleanliness.[19] The solution lay in discovering preventive and ameliorative measures. Accordingly, in 1907 Marion Dorset, a researcher at the Agricultural College at Ames, Iowa, noticed that hogs injected with a combination of anti-toxin and cholera germs developed a resistance to the dreaded plague.[20] Seven years later H.C. Carel, a Minneapolis scientist, discovered a cure for infected animals. Injecting stricken stock with a chemical known as benetol, he observed a complete disappearance of the ailment.[21] With the eradication of sheep scab and hog cholera, veterinary science had made a lasting impression on the livestock industry.

Making full use of veterinary discoveries, the federal government did much to control livestock epidemics in the Northwest during 1880-1925. The first governmental intervention occurred in 1868 when the prevalence of Texas fever in the United States forced the Department of Agriculture to outlaw the importation of American cattle. Eight years later, after securing the post of Dominion Veterinary Inspector, Duncan McEachran, a Montreal veterinary surgeon, erected animal quarantine stations at Halifax, St. John and Quebec.[22] Under McEachran's tenure livestock inspection was introduced to the Northwest. Working under the guidance of the Commissioner of the North West Mounted Police, accredited veterinarians attempted to eradicate bovine, horse, sheep and hog maladies. The establishment of the Health of Animals Branch in 1902, a division of the Department of Agriculture, proved a harbinger for change. After the creation of Alberta and Saskatchewan, this section endowed each province with its own superintendent, "who acts under orders from Ottawa, and has at his disposal a number of veterinarians trained in the work peculiar to disease detection and control." An earlier 1903 Contagious Diseases Act assisted the new body in eradicating livestock epidemics. Legal obligations to report ailments such as hog cholera led farmers to co-operate with government inspectors. By 1920 the federal government programme had become so successful that the *Grain Growers' Guide*, a strong critic of government policy, praised Canadian stock inspection as being the finest in the world.[23]

Duncan McEachran was the leading early figure in the development of veterinary inspection, quarantine and disease control in Canada. Many of the policies devised stemmed from his own concepts. McEachran was born in Scotland and graduated from the Royal Veterinary College in Edinburgh in 1862. Emigrating to Canada, he practised his profession in Woodstock, Ontario. After a brief stint as a lecturer at the Ontario Agricultural College, he founded a similar institution in Montreal, but one offering more intensive career training. His contribution to prairie livestock improvement dates back to his initial government appointment. Remaining in Montreal he held his livestock inspectorship simultaneously with various administrative positions, including one at McGill University after 1889. Virtually single-handedly he directed Canada's livestock inspection effort in the Northwest.[24]

The 1880s marked the beginning of livestock inspection and quarantine on the Canadian Plains. By the decade's mid-point trained veterinarians posted near the international boundary examined all horses and mules (and probably cattle) entering from the United States.[25] At approximately the same time McEachran was making forays into the region to scrutinize isolated epidemics. In January 1886 he travelled to Beausejour, Manitoba, to ascertain the extent of a sheep scab outbreak. Since dipping proved impossible during the winter months, McEachran chose to impose a strict quarantine on all infected farms and to prohibit the movement of afflicted sheep to areas untouched by the disease.[26] Two years later McEachran was despatched westward again - this time to the Cypress Hills. A suspected case of cattle anthrax prompted the government to issue him instructions to examine reports of veterinarians in the field and to take ameliorative steps if the ailment was prevalent.[27] From these small beginnings a comprehensive animal health programme evolved.

During the 1890s and early 20th century the North West Mounted Police assumed responsibilities for animal inspection and quarantine in the North-West Territories. Initial manifestations of public opposition to the government's scheme soon disappeared. Lawrence Herchmer, NWMP Commissioner, asserted that "the small farmers, with only four or five head of cattle naturally object to have probably their best cow killed, but they are now becoming alive to the danger incurred by the rest of their herd, and are destroying them when treatment is found useless."[28] Fully operational during the final years of the 19th century, the programme was broad in scope.

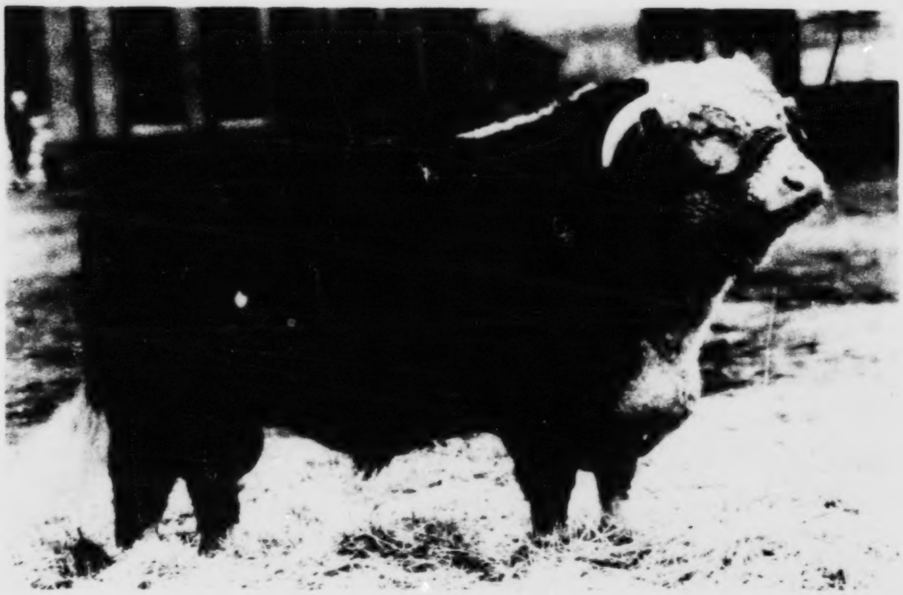

Figure 6. Canadian Grand Champion Hereford Bull, 1931. (Glenbow-Alberta Institute, Calgary.)

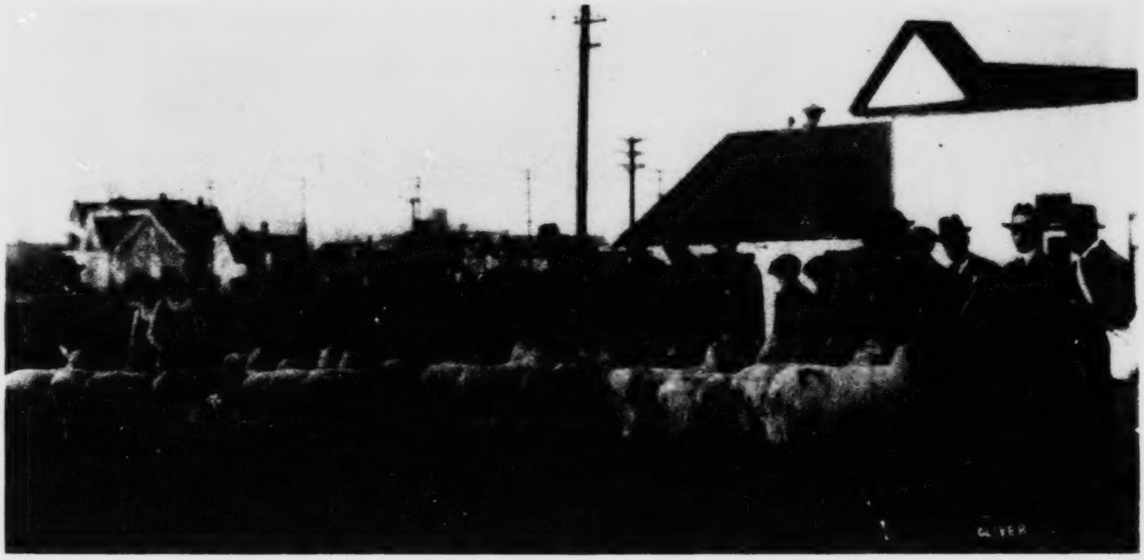

Figure 7. Judging a class of sheep, Calgary, ca. 1913-19. (Glenbow-Alberta Institute, Calgary.)

Live Stock Photo Co.

Figure 8. Lady Trojan Mahomet, Grand Champion Clydesdale Mare, 1929. (Saskatchewan Archives Photograph.)

Figure 9. Thomas Rawlinson and shire horse Innisfail King, Innisfail, Alberta, 1936. (Glenbow-Alberta Institute, Calgary, 1936.)

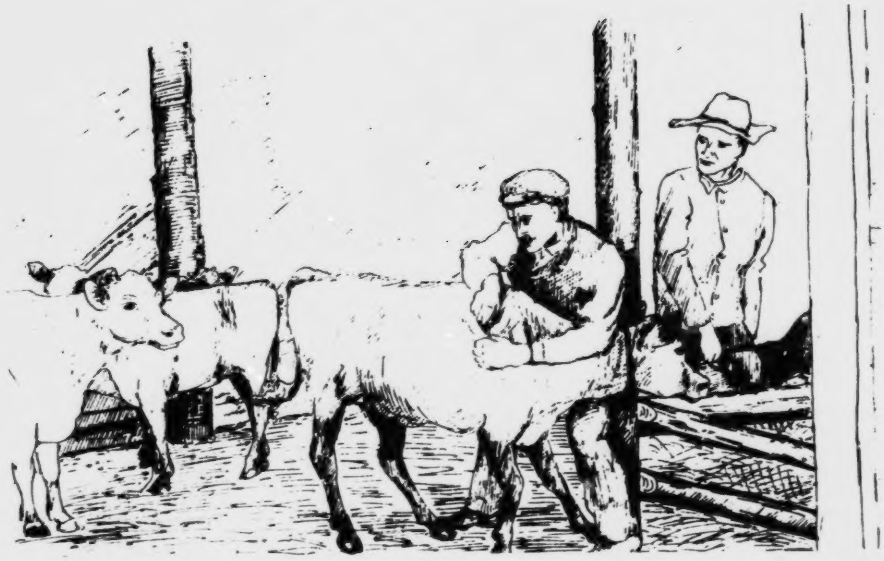

Figure 10. Vaccinating calves with blackleg vaccine, A. Brooks, farmer, 1905. (Copied from "Sketches of Ranching Life in Sunny Alberta," Glenbow-Alberta Institute, Calgary.)

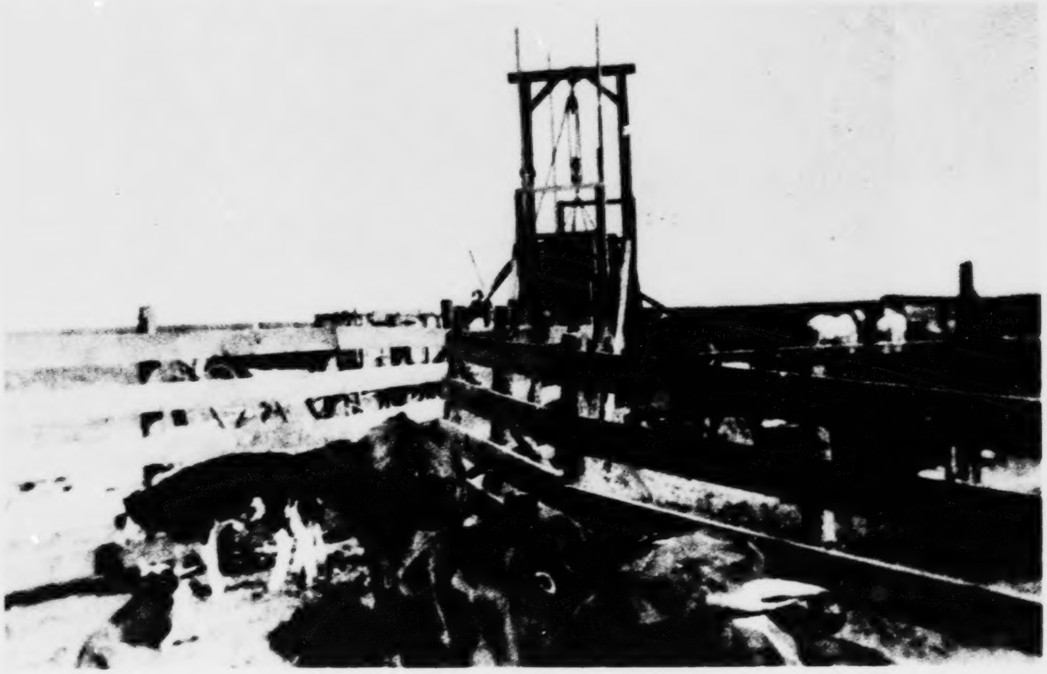

Figure 11. Cattle dip, Lonebutte, Alberta, 1917 or 1918. (Glenbow-Alberta Institute, Calgary.)

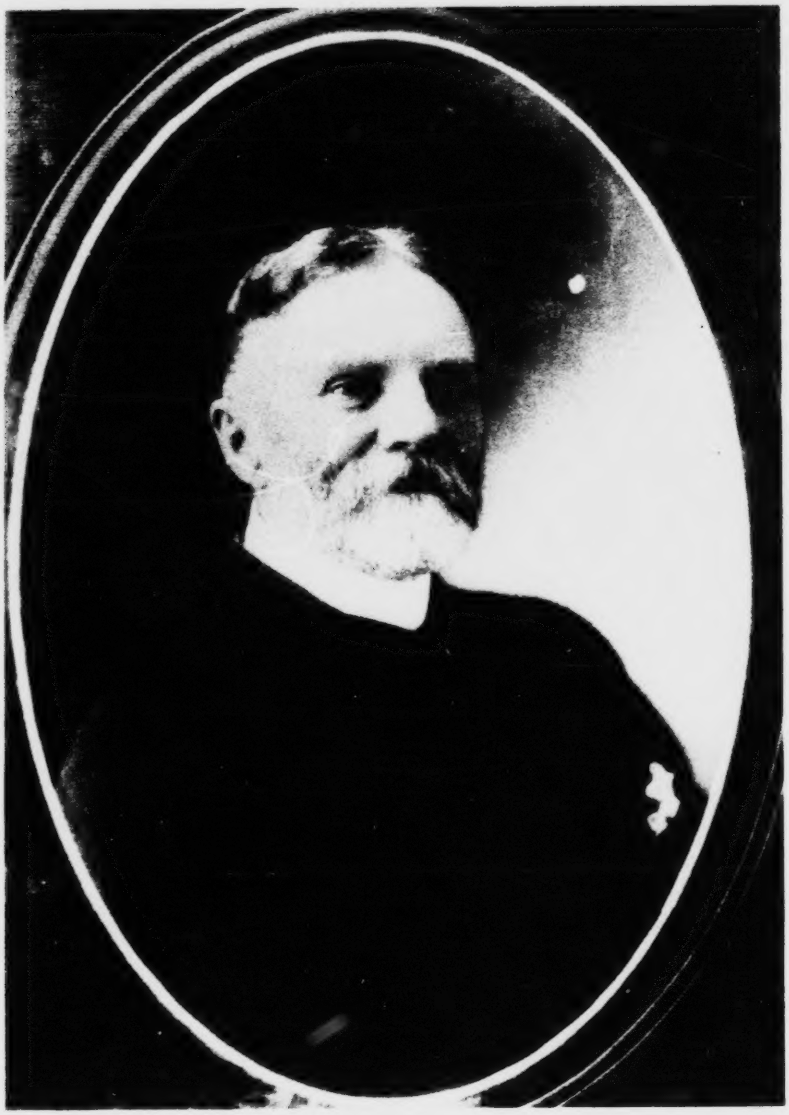

Figure 12. Lawrence W. Herchmer, Commissioner, North West Mounted Police, 1880s. (Public Archives of Canada PA42150.)

Inspectors discovered only 20 diseased export cattle out of a 4500 total in 1899. Moreover, examiners provided a clean bill of health for all animals imported from the United States during the same year.[29] In the course of their work, NWMP investigators also implemented quarantines and reported ailing animals. In 1899 Herchmer suggested that cattle in the Maple Creek area required dipping to free them of mange. He also stated that his department had destroyed large numbers of glanders-infested horses. Two years later Herchmer's successor, A.B. Perry, painted a brighter picture of animal health. Declines had been observed in cases of anthrax, mange and tuberculosis.[30] McEachran's programme was proving effective.

Tuberculin testing, blackleg innoculation, and mange dipping constituted three of the more important functions performed by North West Mounted Police veterinary inspectors. The spread of tuberculosis in cattle elicited concern among Department of Agriculture officials. As early as 1898 investigators applied the tuberculin test in the North-West Territories and destroyed infected animals. The disease's discovery led to a general quarantine. The animal's dwelling spot was isolated from further contact with man or animal. If husbandmen relocated afflicted stock "those premises must also be quarantined until the ailments are disposed of."[31] Other diseases such as blackleg merited preventive measures. Under an arrangement with the Department of Agriculture, the North West Mounted Police stocked blackleg vaccine serum in Regina, issuing the substance at cost price to stock owners when the need arose.[32] The Department even provided treatment for cattle suffering from mange. When an epidemic occurred along the present Saskatchewan-Alberta boundary, inspectors erected dips at several regional points. Officials forbade the movement of stock from the affected area by making it mandatory for each cow to pass a health examination.[33] Nineteenth-century inspection, quarantine, and disease eradication measures improved animal health substantially and paved the way for later advances.

The first two decades of the 20th century constitute a period in which the Dominion government refined its animal inspection and quarantine programmes. Two outstanding prairie veterinarians, John G. Rutherford and Fred W. Torrance, stood at the forefront as government decision makers. In 1902 Rutherford secured the post of Chief Veterinary Inspector. Four years later the Livestock Commissionership was added to his already onerous responsibilities.[34] Torrance served as Rutherford's direct successor. Upon the latter's resignation in 1912, Torrance became Canada's leading animal health investigator.[35]

Education and experience equipped both individuals to handle their duties. While Rutherford graduated from Ontario's agricultural and veterinary colleges, Torrance received his post-secondary training at McGill University and the Montreal Veterinary College. Both veterinarians made Manitoba their home; Rutherford practised veterinary science in Portage la Prairie and held provincial and federal parliamentary seats, while Torrance worked in Brandon and Winnipeg before teaching veterinary science at the Manitoba Agricultural College.[36] Rutherford and Torrance played key roles in transforming loose federal animal inspection and quarantine endeavours into a series of rigidly enforced safety precautions.

Rutherford's chief contribution lay in establishing rigorous cattle mange and tuberculosis controls. Soon after his initial appointment, he convinced his superiors to pass Orders-in-Council outlining stringent anti-cattle mange measures. Now becoming compulsory, dipping consisted of "immersion [of cattle] for not less than two minutes in a solution of lime and sulphur of a strength of not less than 10 pounds of lime and 24 pounds of sulphur to 100 gallons of water prepared according to directives of the officers of the Department of Agriculture.' The Department imposed further restrictions on infected stocks. Railroads became liable to punitive measures if they willingly transported uninspected cattle from a quarantined region. Approved mange-free animals could only be shipped from specially designated stockyards, provided these facilities and the boxcars in which cattle were transported received a thorough disinfection after each consignment's delivery. Moreover, cattle passing from one region to another could not come into contact with quarantined stock. If uncontaminated cattle required unloading in a cordoned-off area, the Health of Animals Branch reserved a disease-free yard. The government maintained the prerogative to quarantine, dip, or kill afflicted animals regardless of their owners' views and bill stockmen for the service.[37]

Government officials enforced similar measures to counter cattle tuberculosis. J.G. Rutherford discovered that the standard measure to pinpoint infected cattle, the tuberculin test, proved ineffective because 8-50 days could elapse before an animal's reaction could be diagnosed. Ostensibly disease-free animals could in fact be afflicted with this dreaded disease. New precautions became necessary. After investigators unearthed the disorder in a herd, all animals became subject to a lengthy quarantine.[38] The measures undertaken under Rutherford's guidance checked the spread of bovine disorders.

The Health of Animals Branch attempted to eradicate sheep and hog diseases. In 1905 Rutherford launched a new assault on sheep scab. Under authority of an Order-in-Council, his subordinates could dip livestock in quarantined-off areas including farmyards and railroad cars. Disinfection of yards, stables, outhouses, wagons, carts and carriages would be carried out at the owners' expense to the satisfaction of the veterinary inspector.[39] Fred Torrance directed a similar campaign against hog cholera in 1917. Revised regulations disallowed feeding hogs uncooked garbage, a practice that had previously led to many cholera outbreaks.[40] When the disease did erupt investigators destroyed afflicted stock. Exposed but unaffected hogs received anti-toxin serum and were thereafter quarantined. Officials scrutinized their eventual slaughter and ordered stringent disinfection measures. All quarantined premises sustained two cleanings - the first after infected swine had been slaughtered and the second after the butchering of innoculated pigs. By banning the introduction of new hogs to the quarantined area until three months after final disinfection, officials halted the spread of the epidemic.[41]

Statistics illustrate the intensity of the government's disease control effort. In the early 20th century the eradication of cattle mange became a priority. When a leading veterinary inspector reported the illness in southwestern Saskatchewan and southeastern Alberta, the Dominion government responded by dipping 520,828 cattle once and 392, 239 twice.[42] Seven years later authorities emphasized hog cholera control. After destroying 1416 hogs out of a total of 7564 examined, D.S. Tamblyn, Saskatchewan's Veterinary Inspector, declared that greater farmer precautions were mandatory if the ailment was to be entirely eliminated.[43] Increases in the numbers of livestock inspected at Saskatchewan's international ports of entry reflect stepped up Veterinary Branch activity. At North Portal alone, 6504 horses, 6997 cattle and lesser number of mules, sheep and swine received clearance in 1905.[44] In 1913, 19,451 horses, 5714 cattle, and 34,377 sheep were inspected at Saskatchewan towns bordering the 49th parallel.[45] Clearly, the federal programme held numerical significance.

The federal government's scheme to control and eradicate animal diseases proved fruitful. By 1920 investigators reported few epidemics. Thorough Veterinary Branch proceedings complemented the efforts of the Ontario Veterinary College and individual practitioners in launching a final assault on animal diseases.

Improvements in Animal Husbandry Techniques

The eradication of disease was supplemented by practical improvements in dairy, beef cattle, sheep and swine husbandry during 1880 to 1925. Leading dairyists developed techniques permitting farmers to obtain year-round milk yields from their herds. Experimenters devised means of fattening beef cattle quickly and economically. From the haphazard methods of the 1880s sheep raising evolved to a punctilious science in the 20th century. Even hog raising became a sophisticated pastime with advances in breeding and feeding. Overall improvements touched all aspects of animal raising except barn technology - an omission that proved highly detrimental to the industry's advancement.

Milch cattle rearing refinements can be divided into two stages - pre- and post-1900. During the first period dairymen discovered procedures for realizing year-round milk yields. Bovine selection, calf raising, diet balancing, and milk cleanliness maintenance received attention during the succeeding epoch. By 1920 they possessed a relatively complete body of knowledge.

Viewing the dairy cow as a milk-producing machine, 19th-century animal husbandmen sought to make this living device profitable. A writer in a leading agricultural journal described the beast as "an artificial product.... [who] must have [an] abundance of succulent feed with as much of concentrated feed added to that as she can [to] turn to profitable account."[46] The solution now lay in converting forage rations into the largest possible milk supply.

Nineteenth-century experimentalists addressed themselves to at least one major problem - that of general diet. During the century's concluding years a number of proposals were aired. A Manitoba farmer suggested that milch cows be provided with a mixture of oats, mangels and crushed flax. Manitoba's provincial veterinarian believed that well-cured natural hay cut in August would prove suitable.[47] S.A. Bedford, Superintendent of the Dominion Experimental Farm at Brandon, advocated supplementing natural pasture grasses with rapeseed, corn or barley. By 1897 leading husbandmen proposed that farmers pasture their stock on bromegrass - a crop that maintained its lusciousness for a longer period than native grass.[48] Stockmen generally considered oats and native grass as constituting prime feed, provided they were augmented wth a variety of delicacies.

Stockmen now turned their attention to fall and winter rationing. As early as 1888 the *Nor'-West Farmer* advised that "providing a supply of more palatable or more concentrated food to make up the shortage caused by the drying out of the natural grasses would allow cattle to maintain their plumpness." A daily supply of turnips constituted the supplementary feed.[49] S.A. Bedford envisaged the use of other crops. He recommended that farmers fortify coarse grain diets with root crops, fodder corn and bran in spring, autumn and winter.[50] Nineteenth-century agriculturalists agreed that some form of succulent feed would maintain milch cow health and the ability to produce the money-making liquid during periods of poor pasture. At the century's close, feeding rations geared to ensuring satisfactory milk yields had been developed to a limited extent.

As an ancillary measure, stockmen devised methods for safeguarding animal cleanliness during the 1880s and 1890s. Without warning, husbandmen launched an attack on the milch cow's tail. In a surprisingly aggressive tone the *Nor'-West Farmer* declared that "it is decidedly unpleasant and not in good taste to have a tail fresh from the manure gutter strike the milker full in the face." Retributive measures became necessary. A set of tools designed exclusively for removing the tail would prove eminently satisfactory as well as financially rewarding to their inventor.[51] Once free of its producer, milk needed special care. After removal from the barnyard, a thorough straining of the liquid was suggested to remove foreign particles. Constructed of fine wire mesh, a filtering device isolated all impurities. Specialists also prescribed cooling and aeration, but the costly equipment necessary for performing these functions severely limited popularization attempts.[52] Tail removal and milk filtration were important steps in maintaining produce cleanliness - final measures that ensured the labour involved in proper dieting had not been wasted.

Twentieth-century dairying advances overshadowed the preceding century's achievements. Instead of confining themselves to feeding experiments, leading husbandmen approached the entire gamut of cow rearing - selection, breeding and dieting. Before farmers could partake in the benefits resulting from new advances, they had to select animals. Their choice was simple: the Holstein-Friesan cow. Hardy and vigorous, Holstein calves fed on skim milk, oil meal, bran and rough pasturage, matured rapidly, and could procreate within two years. As milk producers, they supplied their owners with 5000-6000 pounds annually at two years of age and 7000-9000 pounds three years later. When their milk production decreased, their carcasses could still provide excellent beef.[53] After opting for this versatile breed, stockmen engated in the intricacies of calf raising and scientific dieting.

Calf raising received considerable attention. After a calf was born, experts suggested that it should be left with its mother for two or three days. Following removal from maternal care, the stockman taught the animal to consume liquids. Calves did not drink instinctively. A leading agriculturalist recommended that the farmer manipulate the animal's jaws while inserting its mouth into a milk pail. For an entire week the calf should be fed whole milk. In the subsequent period stockmen gradually transformed the ration to skim milk while adding small amounts of flaxseed jelly to the mixture.[54] Above all, calves demanded gentle treatment. The *Saskatchewan Farmer* urged husbandmen to spend ample time handling and petting the animals. Clement treatment induced calves to become co-operative milkers in later life.[55]

Experimentalists perfected dieting techniques. The first rule of thumb lay in feeding cattle generously. Balancing the regimen became crucial. Two types of foods were available: carbohydrates and proteins. Producing heat and energy, carbohydrates consisted of corn, oat-straw and sunflowers. Proteins developed animal muscles and flesh, and in the case of milch cows produced "the albumen and curd portions of milk." The average 1000-pound creature required 2 1/2 pounds of digestible protein and 12-15 pounds carbohydrates daily. Moreover, experts urged farmers to provide their stock with a substantial quantity of tepid water.[56] Fed at regular intervals and in the proper fashion, milch cows became productive and profitable.

Only one phase can be discerned in the evolution of beef cattle raising technology - steer feeding for profitable purposes. From the 1880s onwards experimentalists tested various rations and informed farmers of each fodder crop's place in the stages of a steer's life. By the 1890s stockmen were able to identify the qualities they desired in steers. Moreover, they could pinpoint how long a steer should be fed to realize a profit. Insofar as physical appearance was concerned, an animal's physical structure mattered more than colour or breed. Suitable animals had loose but thick hides - too thin meant a weak constitution. Other desirable characteristics included broad shoulders, forelegs set wide apart, well-sprung ribs, and fleshy thighs. According to a leading farm journal, husbandmen needed an animal "well developed in the good cuts, as fore and middle ribs, loin and buttocks, and with head and bone on the fine side."[57] This ideal beast should only be retained for a limited period of time for "there is twice as much profit in the first year's feeding as in the second and three times as much as in the third." Anything longer than two years would significantly reduce the husbandmen's gain.[58] The objective in steer raising lay in procuring suitable stock, fattening them quickly, and marketing the finished product.

Naturally, diet played an important role in fattening the cattle. In general, hay proved unsatisfactory unless supplemented by turnips, oil cake or oat straw.[59] With the availability of fresh pasture, cattle fattened best in autumn and spring.[60] During the winter months steers could be fed wheat and hay, but a pure carbohydrate ration could only weaken animals. To overcome the problem in 1895 Angus MacKay advocated supplementing the grain quantum with turnips and green oats.[61] Twenty-one years later, W.C. Mckillican, Superintendent of the Brandon Experimental Farm, urged farmers to fortify the recommended oats and barley ration with corn silage.[62] Well-fed cattle retained for the prescribed period could prove relatively trouble-free and profitable to the stockman.

Before 1900 sheep raising was carried on haphazardly as farmers paid little attention to breeding, feeding and pasturing, and neglected wool preparations. Twentieth-century experts believed that the key to successful sheep husbandry lay in selecting animals capable of withstanding the prairie climate. The ideal type of sheep was a mutton-producing animal that would provide wool as a by-product. However, a leading agriculturalist warned that wool "must not be neglected, but it should never be the object to produce a fine delaine fleece rather a medium quality, for always where fineness of fleece is emphasized, mutton characteristics cannot attain the highest perfection."[63] Generally animals of the Merino type fitted prairie requirements most satisfactorily. Robust in structure they provided excellent meat as well as acceptable wool.[64]

To market a suitable product, great precautions in breeding became mandatory. Firstly, husbandmen secured a satisfactory ram. Possessing a high quality carcass and wool, the suggested purebred boasted a rugged, compact, masculine appearance, "bold carriage [and] stronger bone." Mating was finical. A strong one-year-old lamb could beget 15 well-proportioned ewes. Experts suggested that farmers place older rams with flocks from 15 to 25 ewes. An ambitious, but overexerted lamb tended to sire weak offspring. Shortly after birth all sheep should have their tails removed while all males should be castrated.[65] With these steps taken, lambs could begin a useful life.

Profitable sheep farming necessitated proper feeding. During periods of luscious growth stockmen pastured their animals on virtually anything including stink weed and Russian thistle. With pasturage supplemented by rye, rapeseed and corn during spring, summer and autumn, sheep matured quickly.[66] In winter the addition of certain delicacies helped to maintain livestock health. A leading husbandman, J.B. Spencer, urged that grain be augmented with clover hay, mangels or turnips. Farmers avoided the use of ensilage because its acidity led to sheep indigestion, increased body temperature and loosened wool strands.[67]

Dipping constituted another method of maintaining livestock health. Experts urged stock raisers to immerse their flocks semi-annually. The process proved advantageous for a number of reasons. According to W.H.J. Tisdale of the Saskatchewan College of Agariculture, "the sheep appreciate it." Discomfort caused by the presence of ticks, lice and scab vanished. By opening pores, chemicals stimulated wool growth.[68] A happy and healthy animal fattened quickly.

Wool preparation was the final task before marketing the mutton sheep's ancillary product. The farmer's key responsibility lay in maintaining wool's dryness. Delivery of a moist product invariably resulted in downgrading and reduced financial returns. Impurities led to similar results. The Dominion Department of Agriculture instructed husbandmen to delete straw, chaff and dung locks from each shipment. Moreover, fleece of exceptional quality needed separate baling with different colours kept apart.[69] Selecting and breeding sheep in the suggested manner, providing adequate feed, dipping regularly and preparing wool properly yielded an adequate product.

Experimentalists devised and perfected hog-rearing techniques during the late 19th and early 20th centuries. At first farmers raised swine primitively. By 1900 considerable knowledge on feeding and pregnancy had been accumulated. In 1920 hog-raising know-how extended to breed selection, dairy product rationing and pasturing.

Early hog-rearing methods were almost antediluvian. To keep hogs clean, stock growers were counselled to wash each animal individually on a weekly basis. Pig pens served as repositories for farm trash. Swine supposedly converted ashes and garden rubbish into valuable manure. Swine could be nurtured on anything - beans, fish, peas, grass roots, scrap meat, or table wastes. With gentle handling, farmers supposedly realized marketable hogs and certain profits.[70] Husbandmen gave no consideration to the possibility that uncontrolled and indiscriminate feeding might lead to outbreaks of such epidemics as hog cholera.

Breeding and feeding improvements constitute the chief accomplishment of the 1890s. If a farmer wished to breed swine, his first task lay in selecting sows. Some experimentalists suggested that mature animals reproduced most effectively because while pregnant they only needed to maintain their own flesh and feed their embryos. On the other hand, immature pigs needed carbohydrates and proteins to continue their own growth. Diverting rations from the foetus, this latter function led to the appearance of undernourished offspring.

During the course of a sow's pregnancy its body required a balanced diet. Since the stockman wished to develop the sow's foetus, he fed his swine muscle-producing proteins rather than carbohydrates. An ideal ration consisted of wheat bran, corn meal, oil meal, and well-cured clover hay. Experts also suggested offering each animal a daily turnip.[71] Newly born piglets demanded special attention. A large pen enabled the sow's young to move about freely. At six weeks pigs were weaned on all the skim milk the farmer could provide.[72] Careful selection, breeding and feeding of sows and their offspring could only lead to stock upgrading.

After 1900 developments in hog selection, dairy by-product rationing, and pasturing converted swine husbandry into a sophisticated endeavor. Farmers devoted considerable attention to determining the ideal animal for prairie conditions. Generally, individual qualities of particular beats overruled the significance of specific breeds. Farmers favoured swine "that will yield the greatest profit at the block after a seven or eight months' feeding period." Each strain possessed advantages. A British species, the Yorkshire fattened easily and matured quickly. Hardy and highly prone to rapid reproduction, another British breed, the Berkshire, could only develop to a smaller size. American hogs attracted the farmers' attention. The round-shaped Poland-China derived its attraction from its ability to fatten quickly, while a second American variety, the Duroc-Jersey, resembled the Poland-China but boasted a heavier build. It remained for the stockman to select the proper species for his requirements.[73]

Twentieth-century stockmen discovered the utility of dairy by-products in hog fattening. Added to hogs' regular diet, skim milk, butter milk, or whey dilated animals' strength and weight. Skim milk or butter milk proved indispensable in reinforcing muscles and bones of young pigs. Mature animals also benefited. Before being marketed, farmers could fatten their stock with slightly fermented skim milk.[74] Milk by-products thus enhanced hog quality.

Experimentalists determined that seasonal pasturing proved highly beneficial to the overall growth of husbandmen's stock. Although oats, barley and wheat could be used, alfalfa provided the most succulent feed. The *Nor'-West Farmer* stated:

> The advantage to the pigs of being pasture fed is greater than the increased gains in weight while on pasture. The exercise and open air life make them healthy and vigorous. They grow rather than fatten and come in off the pasture in such thrifty condition that they are ready to make unusually good gains when finished off in yard or piggery.[75]

Late 19th- and early 20th-century developments eliminated much of the risk of hog rearing.

The 1880-1925 period witnessed key improvements in animal-rearing methodology. By the early 1920s technology existed in a number of areas, thus making animal husbandry less of a risk. The farmers still lacked advanced barn architecture.

Advances in Farm-Building Technology

Builders realized only slight advances in barn and silo architecture from 1880 to 1925. Husbandmen perceived inadequate ventilation as constituting a bloc to warm and dry barns, but inadequate technology prevented them from rectifying the situation. Developments can be divided into two periods, 1880-1910 when stockmen exhibited little interest in animal housing and 1911-25 when architectural methods did not match the concern manifested.

With the exception of John Gunion Rutherford's work, barn designers accomplished little during the pre-1920 era. Rutherford defined the problems of improper ventilation and moisture accumulation and suggested means for their elimination. In proferring improvements for sheep and swine housing other advocates lagged far behind. During this time the silo made its first appearance in Canada, but it too seemed ill-constructed to survive the harsh prairie winter.

Barns appeared on the Prairies early in the region's development. Ideally, they faced southward to secure all available sunlight. Possessing a stone foundation, gambrel roof and plenty of screened windows, the usual arrangement provided for animal stalls bisected by a wide passageway running the length of the structure. Doors with cut-outs served as ventilators.[76] A number of problems plagued the design. The usage of stone walls caused winter dampness. If farmers opened doors to improve air circulation, livestock nearest the openings could contract contagious diseases. The lack of suggestions for a suitable floor covering posed difficulties. The failure to construct a system for animal waste removal fomented the spread of epidemics. In short, early barn plans lacked many necessities.

Pre-1910 sheep housing was primitive. Rams and ewes required dry, draught-free, but not necessarily warm shelter. The *Nor'-West Farmer* suggested that sheep could withstand cold better than other domesticated animals because "the yolk that is secreted from the skin of the sheep for the nourishment of the wool makes the skin of the sheep rather insensitive to cold." Sheep sheds need not be overly warm because "the moisture exhaled from the lungs of sheep confined in a close pen makes the fleece damp and when sheep are turned out into the cold air they catch cold, resulting in catarrh or influenza." On the other hand, sheep should not be subjected to draughty barns since similar results ensued. The ideal shelter according to early 20th-century stockmen consisted of a simple shed that supposedly protected animals from cold wind, yet remained open to a roomy yard pointed eastward. These structures neither required flooring nor periodical cleaning of excrement.[77] If farmers heeded such suggestions disaster would certainly result. Easterly or northeasterly winds would send chills swishing through the shed's open door. Manure-laden floors constituted a distinct health hazard. On warm winter days, liquid and solid excrement soaked into the ground, polluted the farm water supply, and spread contagious disease. Farmers had not grasped the principles for providing suitable sheep housing.

Slight improvements were realized in hog house plans. More sophisticated early 20th-century structures replaced 1890s designs. At first, farmers introduced 19th-century Minnesota models to the Prairies. Substantial in size, one early structure measured 28 feet long, 25 feet wide and 6 feet high. The interior contained two rows of pens separated by an eight-foot-wide alley. Farmers placed removeable wooden boards over the cement floor and troughs, thereby endowing the structure with a waste extraction system. Other than windows, no ventilation system existed. Farmers realized the shelter's shortcomings. At farrowing time one stock grower reported that he remained in the building to stoke the heating stove and place newly born pigs in a basket near the fire![78] Moreover, a ventilation system using only windows tended to cause dampness or draughts in winter.

By 1905 hog-housing technology had advanced to the point that farmers advocated that good piggeries be properly lit, warm, moisture-free and well-ventilated. Utilizing basically the same 1890s American architectural drawings, experts now suggested they should be augmented with proper ventilation systems. The new set-up consisted of several tubes bordering the edifice's walls. With outside air inlets placed between 12 and 18 inches from the barn floor, the pipes rose to within 3 inches of the ceiling. At both top and bottom these shafts turned at right angles and followed the wall's contours. Dampers controlled the flow of inside and outside air.[79] No evidence exists concerning the system's efficacy. However, it appears that strong breezes could create blustery conditions inside the shelter while tranquility rendered the mechanism inoperative. Progress had been achieved insofar as farmers now realized the need for such structural improvements.

John Gunion Rutherford pioneered in criticizing 19th-century barn architecture and propounding ameliorative measures. He directed his attack on two fronts - improper drainage and ventilation. To facilitate proper runoff, Rutherford argued, barns should be erected on elevated sites. At the chosen location the water level should be more than six feet below the ground surface. Barn floors also merited attention. Urging farmers to embed wood planking or brick into a concrete surface, he asserted that "the best floor is one impervious to moisture and capable of being kept clean and dry by ordinary care and surface drainage."[80]

Ventilation complemented drainage as an area of concern. Rutherford believed that "the problem of efficient winter ventilation [was] one of extreme difficulty." In the stable an overabundance of carbon dioxide created a health hazard for livestock. In totally enclosed structures animals breathed oxygen, nitrogen and carbon dioxide. Useless in sustaining life, cattle, sheep and swine merely used nitrogren to dilute the life-maintaining gas. Since animals consumed a significant part of the oxygen content, carbon dioxide constituted a substantial portion of the gas exhaled. The lack of oxygen and the dominance of carbon dioxide facilitated the growth of anthrax, tuberculosis and glander germs. Thus sufficient fresh air became necessary. Ideally such common animals as horses needed 15,000 cubic feet of fresh air hourly. Allotting 500 cubic feet breathing space to each animal, the average barn required 30 hourly infusions of oxygen. It was Rutherford's considered belief that in cold weather this standard was unattainable.[81] So Rutherford devised a barn ventilation system. A cone-topped metal chimney emitted waste gasses from the chosen edifice. U-shaped pipes with outdoor ventilation openings injected unpolluted air into the building. The intake pipes travelled briefly underground before entering the barn at floor level. The short voyage supposedly warmed the cold air. Rope-manipulated inlet and outlet dampers regulated the edifice's temperature. But the system possessed a number of disadvantages. Frost could plug the pipes. When stockmen closed the valves dampness prevailed. It is also suspected that the system caused draughtiness on blustery winter days. When Rutherford appeared before a Select Standing Committee on Agriculture and Colonization in 1906, a member of Parliament subjected him to ridicule by facetiously suggesting that the system be installed in the Commons chamber to nullify the discomfort of Ottawa's infamously humid summers.[82]

Silos first appeared in Canada before 1910. The stave silo became the first such construct to attract government and farmer attention because of its simplicity. Carpenters encountered few difficulties in erecting structures. A two-feet-deep concrete reinforced excavation served as the base. Upon this foundation workmen attached 20-feet-long pine or spruce staves. Bracing consisted of hoop sections, connected to one another with metal or wooden clips. Other than suggesting that a roof be installed to protect the silo from winter snows, experts believed that their design could be applied unaltered across Canada.[83] Yet early plans did not take into account prairie peculiarities, as hot and cold temperature extremes caused the structure to warp. Refinements became mandatory if designers wished to ensure the success of this silo design on the Prairies.

Prairie stock raisers manifested an increased awareness of the need for improved prairie barn sanitation and ventilation as well as silo modification during 1911-25. Federal government officials, agricultural college teachers and individual farmers now realized that many barn and silo components performed inadequately at the height of the prairie winter. Unfortunately, technology did not alleviate design weaknesses.

The mixed-farming barn attracted considerable attention. Husbandmen devoted their time to discussing the principles of erecting sound foundations and floors, and installing satisfactory ventilators. The barn's exterior remained unchanged; the gambrel roof design preponderated. Experts urged farmers to provide concrete foundations for their structures. The Saskatchewan Department of Agriculture suggested that each cement base extend downward to the sub-soil level. Designers could not overemphasize the importance of suitable flooring. A.G. Greig recommended that concrete flooring always be utilized.[84] *The Grain Growers' Guide* agreed, adding that wood planks be placed over the cement.[85] Further suggestions called for removeable feeding systems and indoor water supplies. One journalist admonished farmers to construct trackage systems to carry fodder into barns and remove manure. Even an indoor water supply was possible if husbandmen proved willing to construct wash basins in each stall, using a portable gasoline engine to fill the tubs.[86]

Ventilation emerged as a much-discussed topic. According to a leading farm periodical in 1915, farmers expressed doubts concerning the ability of contemporary set-ups to remove moisture, yet maintain stable warmth. Ventilation systems required constant attention. Husbandmen balked before installing the finicky devices that demanded skilful and constant adjustment in order to provide a mere semblance of operational efficiency.[87]

Stockmen could choose between two systems - the Rutherford or King. The former had undergone a slight modification. The intake flues no longer ran below ground level, instead being situated several inches above the barn's floor. Alternatively the King system featured pipes paralleling barn trusses. Fresh air entered at ground level and rose up a shaft to a point slightly below the building's ceiling. Vents situated at slightly below ceiling level and one foot above the floor emitted stale gases. Doors controlled intake and outflow.[88]

Pre-1925 barns possessed a number of questionable features. Unaltered concrete floors were prone to dampness and ventilation systems remained imperfect. The modified Rutherford set-up eliminated freezing problems, but performed improperly on blustery or calm days. Farmers possessing the King system could expect to find frozen and damp inside walls on cold winter days.[89] By no means had mixed-farming barns been perfected.

Experts agreed that the sheep barn should be the least expensive of major farm buildings. Supposedly, a simple shed with adjustable windows and open doors was sufficient. Yet for large stock owners a costlier edifice was recommended. Similar in appearance to the mixed-farming barn, the more elaborate structure boasted a concrete foundation, cement root cellar, wide doors and plenty of windows. The bi-level interior featured pens, feed racks and a root house on the ground floor while grain bins and hoppers were located overhead. Proper air circulation could presumably be maintained by constructing 1906 vintage Rutherford ventilation flues.[90] Both the inexpensive and elaborate sheep shelters could cause problems for the farmer. In the case of the former, draughtiness and dampness still resulted from open windows and doors. The elaborate model retained all the disadvantages of the Rutherford system including vent-freezing and irregular air flow. The experts still had not completed their homework.

Early 20th-century barn architecture was nonetheless successful in hog housing. Essentially swine quarters required a number of features. The first element was dryness. To avoid dampness - related disorders in sows and boars, designers urged husbandmen to erect concrete floors or walls.[91] The simple colony house met all moisture-free specifications while larger hog houses proved deficient.

The portable pen proved ideal for hog rearing. A-shaped, it measured eight feet square at its base. Two oak runners 3 x 9 feet facilitated hauling. Since flooring frequently served as a moisture source, designers deliberately penned bottomless blueprints.[92] The heating system was simple. In winter stockgrowers aligned the buildings one foot apart in rows facing south. Large quantities of straw insulated the gaps between structures and virtually concealed the sides, tops and rear elevations. Red outdoors even during the winter, swine fattened quickly and effortlessly. Surrounded by straw, hog shelters could be kept completely moisture free when animals slept indoors.[93]

Elaborate constructs proved less satisfactory. In a large building a wide feeding passage bisected two rows of adjustable pens. At opposite ends stood the cesspit and main entrance. Planks divided by lengthy rubber strips placed over the cement floor permitted cleaning, while screened windows ventilated the structure.[94] Yet these commodious quarters had their problems, as their closed windows increased the buildings' moisture content, causing pigs to contract chills when farmers opened windows on cold days. Technological developments in swine housing favoured the small stock grower over the larger operation.

A series of problems beset prairie silos. Wood tended to warp on stave silos, whereas those constructed with concrete cracked. Pit silos were the most practical.

Stave silos achieved some popularity on the Plains. Although construction techniques remained unchanged since the turn of the century, builders, nevertheless, warned farmers to take certain precautions. In joining boards, tongues should never be fitted too tightly into grooves. Variations between hot and cold, moist and dry weather fomented expansion, contraction and ultimate warping.[95] Moreover, pressure from frost contributed to severe silo contortion.[96]

Concrete silos offered few advantages over their wooden counterparts. Experts advised amateur builders against constructing such structures. Several unique disadvantages can be attributed to cement. Ensilage corroded the substance and caused silo walls to crumble. Tectonic cracks appeared and negated the silo's usefulness. Above all, concrete offered little protection against frost, thereby making spoiled ensilage a distinct possibility.[97]

Only the cost-free trench silo avoided the numerous shortcomings of its counterparts. Its chief advantage lay in its simplicity of construction. The farmer merely excavated to a depth of 8 feet, a width of 16 feet, and as long as he desired. After filling the pit with corn or oats he covered the contents with hay to exert pressure and induce fermentation. Access to the pit was achieved by removing the desired portion of hay.[98] The system was simple and trouble-free.

Conclusion

The 1880-1925 period was notable for the elimination of livestock diseases and the refinement of animal-rearing methods. Science had produced preventive and ameliorative techniques for disease control and elimination. Federal government quarantine and stock inspection reduced hazards even further. Moreover, leading husbandmen evolved means for raising cattle, hogs and sheep efficiently. However, a large gap remained in animal housing. Barn ventilation and dampness still caused stockmen great concern. Animal-housing deficiencies largely negated achievements in other spheres. Also, farmers remained reluctant to undertake extensive stock rearing.

NON-TECHNOLOGICAL LIMITING FACTORS IN PRAIRIE ANIMAL HUSBANDRY

The need for substantial investment hindered the development of animal husbandry in Saskatchewan. Farmers were reluctant to spend money on the appurtenances of mixed farming - sizeable barns, silos, and leguminous crops. Fodders such as bromegrass, clover, and alfalfa yielded uncertain harvests despite their high cost of cultivation. When statistics are tabulated it becomes demonstrably clear that mixed farming was less attractive financially than grain growing.

Forage Crops

A willingness to cultivate forage crops was a prerequisite for engaging in animal husbandry. To feed livestock adequately, farmers required harvests of oats and succulent delicacies such as alfalfa, bromegrass or clover. With the exception of oats, the farmer derived minimal returns from a significant seed investment and lengthy crop maturation period.

As the forage mainstay, oats alone was both practical and profitable to sow. Seed could be acquired for realistic sums. During 1910-15 husbandmen paid $.90 per bushel. Although the price increased to $1.75 by 1920, its cost remained low compared with other grain varieties.[1] Seeding two to three bushels per acre the farmer's total investment was $1.80-$2.70 between 1910 and 1915 and $3.50-$5.25 in 1920. Husbandmen secured annual and fairly steady yields. Averaging 32.7 bushels per acre from 1912 to 1921, harvests seldom dropped below 21.5 bushels and never exceeded 45.9.[2] If a farmer reaped a harvest beyond his fodder requirement, he could dispose of his surplus in a readily available market. Oats could be grown as a fodder or market crop.

To fatten their steers rapidly for the abattoir, stock growers needed to augment their oats acreage with succulent forage crops. Among leguminous feeds, alfalfa was the most desirable and the most costly. Merchants found high quality alfalfa seed difficult to obtain[3] and extremely expensive. In 1910 Turkestan alfalfa, a hybrid poorly suited to dry-belt climatic extremities, brought $23 for 100 pounds. Five years later, Northern Crown, a slightly improved variety, sold for $26.50 per hundredweight. Only in 1920 did Grimm's, an ideal prairie alfalfa, become available. For the stupendous sum of $85 for 100 pounds, the mixed farmer could purchase the seed.[4] The large quantity of seed per acre necessary for ensuring plant survival multiplied the already high sowing cost. Drilling ten pounds seed per acre, the husbandman could only obtain ten acres of forage from the standard hundredweight. Although the sum of $2.30 per acre for Turkestan in 1910 and 1915 may have been affordable by many farmers, Turkestan was not known for its productivity. The $8.50 per acre for Grimm's in 1920 proved too costly to be worthwhile.

Alfalfa possessed a number of additional disadvantages. Expensive seed alone proved insufficient to induce plant growth, as innoculation became mandatory. On each seeded acre, experts urged farmers to spread 200-500 pounds of soil from exhausted alfalfa fields. Generally, farmers found this commodity difficult to obtain. Institutions such as the Manitoba Agricultural College attempted to fill the gap but failed miserably.[5] Perhaps the forage's greatest shortcoming lay in its five-year cropping period. According to W.H. Fairfield, Superintendent of the Dominion Experimental Station at Lethbridge, Alberta, productive fields yielded no crop during their first years, limited harvests during the second and third, and extensive produce during the fourth and fifth.[6] Five years of alfalfa necessitated the sacrifice of several grain crops.

The lack of a market for surplus alfalfa limited its popularity. Although alfalfa fields consistently produced 1.5-1.85 tons of hay per acre during their final two years of productivity and statisticians valued the output at $9.63-$20 per ton, few buyers awaited the crop's harvest.[7] When compared with the $5 per ton average for less exotic hay varieties, buyers found it unprofitable to purchase alfalfa. Yet farmers could find no suitable substitute for fattening livestock quickly and effectively.

Experimentalists hailed bromegrass and sweet clover as alfalfa substitutes but these intended replacements retained the former's disadvantages. Seed was costly. In 1910 brome seed retailed for $13 per hundredweight, while clover commanded $21.50 for a similar amount. By 1920 prices had doubled; Gold Standard Brome listed at $28.50 while Alberta-grown sweet clover sold for $43.00,[8] although both crops needed two years to mature. John Bracken asserted that the first year's brome harvest would be negligible while farmers during the following summer would reap 300-500 pounds hay per acre.[9] Sweet clover matured in a similar manner. After a dismal first year's harvest, this leguminous plant yielded forage in June and August during its final cropping.[10] No recorded market for clover or bromegrass existed. Both fodders constituted expensive investments geared to individual consumption.

To cultivate forage crops farmers diverted valuable wheat lands to alfalfa, bromegrass or clover production and sacrificed assured profits. Wheat could be grown on prairie drylands two out of every three years. Yields undoubtedly varied, monetary returns fluctuated wildly, but markets always existed. With the exception of oats, fodder crops represented pure overhead. Markets for surplus production remained limited or non-existent. Returns from livestock sales were needed to override the expense of these crops.

Building Costs of Mixed Farming

The necessity of erecting substantial barns and silos added to the expenses involved in stock raising. Unlike the grain grower who needed only a simple shed for his draft horses, the mixed farmer required much more elaborate housing for his animals. Only the anticipated profits from the stockyard could lure the farmer into investing the large sums of money required for these buildings.

Barn construction entailed considerable expenditures in both building materials and labour. In 1916 a basic barn containing space for eight cows and horses necessitated an investment of $597.20 for supplies alone. If he possessed the know-how, the farmer could erect the barn himself. Otherwise, skilled labour would command an additional $200-$500.[11] As the husbandman diversified his operations his stock-housing requirements became more involved. A gambrel-roofed structure divided into stalls for 10 horses, 19 cattle, and featuring a bull pen and calf pen, the Rutherford ventilation system could be constructed for $1900 labour inclusive.[12] For the large-scale mixed farmer plans for the ultimate barn existed. Gambrel-roofed like most prairie designs and boasting a concrete foundation and Rutherford ventilation system, this building held 14 horses, 16 cattle, calf and bull pens plus a feed room. A farmer had to spend $2100 for building materials alone for this structure.[13] In relation to the $500-$600 cost of a suitable horse shed, the mixed-farming barn represented a sizeable investment.

The silo complemented the mixed-farming barn. It too represented a substantial expenditure to stock growers. Most economical was the trench silo which necessitated a $30-$50 investment for excavation. Inconvenient content removal confined this subterranean structure to stopgap status.[14] The superstructure was a much more costly proposition. Wooden stave silos commanded upwards of $150 while concrete structures required a greater defrayal. Shrinkage and collapse of such constructs could be costly. The re-building of a wooden silo could total up to $135. Farmers appeared reluctant to put up such expensive and fragile structures. In 1915 only 50 silos existed in Manitoba.[15] Eight years later the Saskatchewan Department of Agriculture reported only 460 operational silos in the province, 167 of these being above-ground constructs.[16]

Required investments for the animal husbandry newcomer were great. Farmers had to devote considerable acreage to forage crops, land that could be more profitably sown with wheat. Barns and silos constituted mandatory expenditures. There was no guarantee, however, that stockyard prices would make the effort worthwhile.

Hypothetical Cost Comparisons of Grain and Mixed Farming

An extrapolated statistical comparison of grain growing and mixed farming from 1910 to 1919 suggests that grain growing proved more

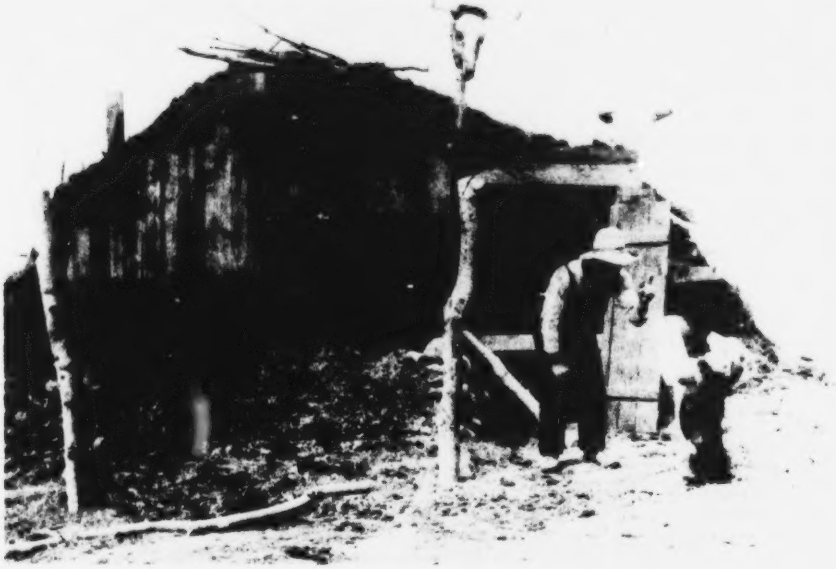

Figure 13. Dug-out of homesteader's barn, n.d. (Saskatchewan Archives Photograph.)

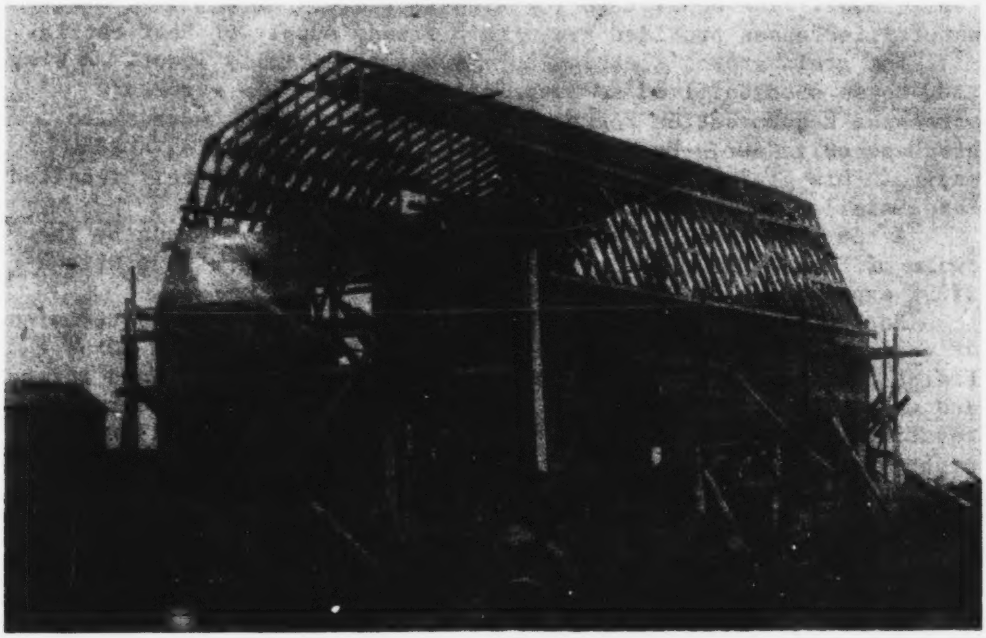

Figure 14. Homestead of W.L. Kirkpatrick who homesteaded in 1903. Barn built in 1917 or 1918, NW-16-36-6W3. (Saskatchewan Archives Photograph.)

profitable in that period. Using statistics from a variety of sources, but in particular the Saskatchewan Department of Agriculture Records, two hypothetical average-sized farms have been created.

Situated in southeastern Saskatchewan, Farm A engages in grain growing and beef cattle raising while Farm B is confined to wheat and oats production. Encompassing 320 acres each both farms were purchased for the same price, $6448, in 1909. The difficulty in determining land values in 1919 prevents property cost from being listed as a variable. Moreover, identical property values at the point of the transactions would make such a comparison meaningless.

To achieve their individual objectives each farm required certain fixed investments. A large barn, silo, livestock and draft animals as well as grain-growing machinery constitute mixed-farming requisites. On the other hand, grain growing could proceed after procuring a small barn, horses and machinery.

The main investment on Farm A consisted of a large gambrel-roofed barn that held 19 cattle plus a bull and calf. It could be constructed for $1400 in 1910. The stave silo appeared as the least expensive practical structure of its kind, and could be put up for $250. Farm A acquired grain-growing machinery at the following prices: seed drill $125, gang plough $80, mower $55, binder $150 and disc harrow $100. Four draft horses valued at $197 each necessitated a $788 expenditure. The owner of Farm A only needed to purchase livestock during his first year of operation. In 1910 he bought ten steers, each weighing 800 pounds at $4.96 per hundredweight - a total outlay of $296.80. He also procured a bull for $101. In 1916 the purebred bull required replacement. The owner then invested an additional $175. Thereafter, natural increases provided him with a steady supply of beef cattle.

The grain grower's expenditure was substantially lower. A simple $500 horse shed sufficed as an animal shelter. This structure possessed accommodation for eight horses even though he chose to purchase only four. Moreover, he had no need for a silo, a $250 saving. His grain-growing machinery and four draft animals retailed for a similar sum as the mixed farmer's.

A ten-year total fixed investment of $3620.80 was made by the owner of Farm A while the grain grower commenced operations with a $1798 expenditure.[17]

Both operations employed the latest scientific farming techniques of their time. Farm A's 320 acres were divided into three 80-acre fields for grain growing and two 40-acre plots for a combined forage and wheat rotation. The three 80-acre fields followed a four-year rotation pattern consisting of wheat, wheat, oats, and fallow. An eight-year pattern consisting of five years alfalfa, two years wheat, and one season's oats was pursued by the farmer on the smaller plots. From 1910 to 1919 the mixed farmer harvested 1440 acres wheat, 640 acres oats and 400 acres alfalfa; 640 acres remained fallow. The grain grower divided Farm B's expanse into four fields, each measuring 80-acres. He followed a four-year wheat, wheat, oats, fallow rotation pattern. By 1919 the farm's owner had reaped 1600 acres wheat and 800 acres oats; 800 acres remained fallow.

Farm A stood alone in beef production. The ten steers purchased in 1910 were butchered after they had produced offspring. Since a two-

Fixed Investment Mixed Farming

10-Year Period	
Barn	
(19 cattle + bull and calf capacity)	$1400
Silo - wooden stave	250
Grain-growing machinery	
Seed drill	125
Gang plough	80
Mower	55
Binder	150
Disc harrow	100
Draft horses	
4 at $197	788
Livestock bulls	
1910	101
1916	175
Cattle in 1910	
10 at $4.96/cwt each 800 lbs.	396.80
10-Year Fixed Investment	$3620.80

Fixed Investment Grain Growing

Barn (simple)	$500
Machinery	
Seed drill	125
Gang plough	80
Mower	55
Binder	150
Disc harrow	100
Draft horses	
4 at $197	778
Total Fixed 10-Year Investment	$1798

Ten-Year Rotation on Mixed Farm
320-Acre Mixed Farm

Years	Field 1 80 A	Field 2 80 A	Field 3 80 A	Field 4 40 A	Field 5 40 A	Wheat	Oats	Alfalfa	Fallow
1910	Wheat	Oats	Fallow	Alfalfa	Wheat	120A	80	0	80
1911	Wheat	Fallow	Wheat	Alfalfa	Wheat	200	0	40	80
1912	Oats	Wheat	Wheat	Alfalfa	Oats	160	120	40	0
1913	Fallow	Wheat	Oats	Alfalfa	Alfalfa	80	80	40	80
1914	Wheat	Oats	Fallow	Alfalfa	Alfalfa	80	80	80	80
1915	Wheat	Fallow	Wheat	Wheat	Alfalfa	200	0	40	80
1916	Oats	Wheat	Wheat	Wheat	Alfalfa	200	80	40	40
1917	Fallow	Wheat	Oats	Oats	Alfalfa	80	120	40	80
1918	Wheat	Oats	Fallow	Alfalfa	Wheat	120	80	40	80
1919	Wheat	Fallow	Alfalfa	Alfalfa	Wheat	200	0	40	80
Totals						1440	640	400	640

year period elapsed between a cow's birth and marketability, Farm A only realized returns from five cattle shipments. Farm A sent 15 cattle to the abattoir in 1912, 18 in 1914, 15 in 1916 and 19 in 1918.

Both farms yielded substantial produce. On both mixed and grain farms all wheat was sown as a cash crop. Husbandmen devoted 20 per cent of oat crops on the mixed and grain farms to forage. Farm A's owner converted all alfalfa yields to ensilage. Mixed-farm wheat yields ranged from 942 bushels in 1914 to 5040 bushels the following year. Less a 20 per cent forage crop deduction, oat harvests fluctuated from a minimum of 1904 bushels in 1914 to 5328 bushels in 1912. Throughout the period, alfalfa yields hovered near the 235,000 pound mark for 40 acres. Marketable beef cattle weighed approximately 1150 pounds each.[18]

Grain farm yields ranged from 1360 wheat bushels in 1919 to 4032 bushels in 1915. Oats bottomed at 1376 bushels in 1918 and topped at 2937.6 bushels in 1915.

Grain Farm Rotation Pattern

Year	Field 1 80 A	Field 2 80 A	Field 3 80 A	Field 4 40 A	Totals		
					Wheat	Oats	Fallow
1910	Wheat	Wheat	Oats	Fallow	160	80	80
1911	Wheat	Oats	Fallow	Wheat	160	80	80
1912	Oats	Fallow	Wheat	Wheat	160	80	80
1913	Fallow	Wheat	Wheat	Oats	160	80	80
1914	Wheat	Wheat	Oats	Fallow	160	80	80
1915	Wheat	Oats	Fallow	Wheat	160	80	80
1916	Oats	Fallow	Wheat	Wheat	160	80	80
1917	Fallow	Wheat	Wheat	Oats	160	80	80
1918	Wheat	Wheat	Oats	Fallow	160	80	80
1919	Wheat	Oats	Fallow	Wheat	160	80	80
Total acreage					1600	800	800

Alfalfa and Beef Yields on Mixed Farm

Year	Alfalfa (40 acres)	No. of Beef Cattle (1150 lbs.)
1910	0	10
1911	235,600 lbs.	0
1912	225,000 lbs.	15
1913	235,000 lbs.	0
1914	471,400 lbs. 2 fields	18
1915	225,000 lbs.	0
1916	235,000 lbs.	15
1917	235,800 lbs.	0
1918	0	19
1919	235,600 lbs.	0

Figures are tabulated from experiments conducted at Dominion Experimental Farm, Indian Head. Canada. *Dominion Experimental Farm Reports*, Indian Head, Sessional Papers, 1913, pp. 319-20.

Farmer A derived his income from wheat, oats and cattle while Farmer B's profits were limited to grain. Twenty per cent of both farmers' oats plus the entire mixed-farm alfalfa harvest served as animal fodder.[19]

Returns from wheat, oats and cattle fluctuated wildly. Wheat prices reached a low of .88¢ per bushel in 1913 and a high of $2.23 five years later. Oats returned a low of .34¢ per bushel in 1913 and a high of .86¢ in 1918. Beef prices varied between $4.96 per hundredweight in 1910 and $13.85 in 1919.

During the ten-year period both farms gave their owners substantial gross monetary returns. Wheat-derived income from the mixed farm stood at an understandably lower value than from the grain farm. A similar situation applied to oats. An added mixed farm bonus lay in beef cattle income - a substantial $6870.68. Before overhead deductions Farm A's $45,019.01 income compared favourably to the $43,607.39 received from grain farm products. Clearly, overhead costs would play a key role in determining net profitability.

Statistics indicate that mixed farming's main liability lay in high initial investments and operating costs. Costly farm buildings and wages for year-round hired help cut deeply into Farm A's profits. Lower overhead transformed grain growing into a more financially rewarding occupation.

Seed constituted a major investment in both operations. In 1910 Farm A required wheat, oats and alfalfa seed. The mixed farmer seeded additional wheat in 1915, oats in 1916 and alfalfa in 1913 and 1918. The grain farm needed only wheat and oat seed in 1910 and 1915. Wheat fields received 1.5 bushels seed per acre, oats 2.5 bushels and alfalfa 9 pounds per acre. Seed prices fluctuated. The grain farm's smaller purchase entailed a somewhat reduced expenditure.

Both farms needed help in threshing wheat, oats and forage crops. The threshing cost for wheat and oats had been tabulated by the bushel. Since both farmers fed 20 per cent of their oats crop unthreshed to livestock, labour costs have been reduced accordingly. Farm A's alfalfa was harvested but the cost per bushel is impossible to pinpoint. Alfalfa threshing for the ten-year period has been assigned the arbitrary sum of $1000.

Total Income from Farms Before Deductions ($)

Year	Mixed Farm				Grain Farm		
	Wheat	Oats	Cattle	Total	Wheat	Oats	Total
1910	1,841.40	661.50	570.40	3,073.30	2,455.20	661.50	3,116.70
1911	3,515.00	0	0	3,515.00	2,812.00	1,036.80	3,848.00
1912	3,120.32	1,747.58	947.03	5,814.93	3,120.32	1.165.06	4,285.38
1913	1,372.80	907.39	0	2,280.19	2,745.60	907.39	3,652.99
1914	992.00	654.98	1,490.40	3,137.38	1,984.00	654.98	3,638.98
1915	6,400.80	0	0	6,400.80	5,120.64	1,556.93	6,672.57
1916	3,919.20	1,226.18	1,328.25	6,473.63	3,155.36	1,226.17	4,361.53
1917	2,499.20	1,775.62	0	4,274.82	4,998.40	1,183.74	6,182.14
1918	2,676.00	1,183.36	2,534.60	6,393.96	3,568.00	1,183.36	4,751.36
1919	3,655.00	0	0	3,655.00	2,924.00	1,167.94	4,091.94
Totals	29,991.72	8,156.61	6,870.68	45,019.01	32,863.52	10,074.87	43,607.39

Seed Investment for Mixed Farm

Wheat	
1910	
120 acres wheat, $1.65/ bushel and 1.5 bushels/acre	$297.00
1915	
200 acres wheat, $1.78/ bushel and 1.5 bushels/acre	$534.00
Oats	
1910	
80 acres oats, $.90/bushel and 2.5 bushels/acre	$180.00
1916	
80 acres oats, $.90/bushel and 2.5 bushels/acre	$180.00
Alfalfa	
1910	
40 acres alfalfa, $.24/lb. and 9 lbs./acre	$ 86.40
1913	
40 acres alfalfa, $.27/lb. and 9 lbs./acre	$ 97.20
1918	
40 acres alfalfa, $.80/lb. and 9 lbs./acre	$288.00
Total seed investment	$1662.60

Seed Investment for Grain Farm

Wheat	
1910	
160 acres wheat, $1.65/bushel and 1.5 bushels/acre	$396.00
1915	
160 acres wheat, $1.78/bushel and 1.5 bushels/acre	$427.20
Oats	
1910	
80 acres oats, $.90/bushel and 2.5 bushels/acre	$180.00
1916	
80 acres oats, $.90/bushel and 2.5 bushels/acre	$180.00
Total investment	$1183.20

Threshing Costs ($)

Year	Mixed Farm			Grain Farm	
	Wheat	Oats	Alfalfa	Wheat	Oats
1910	148.80	116.74		$198.40	116.74
1911	330.78	0		264.62	190.94
1912	284.65	282.60		284.65	188.40
1913	141.02	192.15		282.05	192.15
1914	109.12	137.09		218.25	137.09
1915	756.00	0		604.80	323.14
1916	468.60	275.26		374.88	275.26
1917	340.80	493.90		681.60	295.94
1918	372.00	330.24		496.00	330.24
1919	493.00	0		394.40	354.82
Totals	3,444.77	1,777.98	1,000.00	3,799.64	2,404.72
Grand Totals		6,222.75		6,204.36	

Labour Costs -
One Hired Farm Hand

1910	$287.50
1911	296.00
1912	314.00
1913	306.00
1914	274.00
1915	330.00
1916	465.00
1917	515.00
1918	625.00
1919	832.00
Total	$4245.50

Year-round duties too onerous for one man to perform forced the mixed farmer to hire a labourer. Throughout the decade, farm help commanded high wages. Employment costs contributed greatly to mixed farming's lack of profit potential.

After the deduction of overhead costs, mixed farming yielded a ten-year profit of $29,267.36 or an average annual income of $2926.74. On the other hand, grain growing netted a total profit of $34,421.83 or $3422.18 annually. Grain farming, therefore, was almost 20 per cent more profitable than mixed.

Profits After Overhead Deductions

Farm A - Mixed Farm	
Total fixed investment	$3,620.80
Seed	1,662.60
Threshing	6,222.75
Labour	4,245.50
Total 10-year overhead	$15,751.65
10-year profit	45,019.01
" overhead	-15,751.65
Ten-year profit after deductions	$29,267.36
Average annual income	$29,267.36/10
	$2,926.75
Farm B - Grain Farm	
Total fixed investment	$1,798.00
Seed	1,183.20
Threshing	6,204.36
10-year overhead	$9,185.56
10-year profit	$43,607.39
" overhead	-9,185.56
Ten-year profit after deductions	$34,421.83
Average Annual Income	$34,421.83/10
	$3,442.18
Annual grain growing	$3,442.18
Advantage over mixed farming	-2,926.74
	$515.44

Conclusion

For a variety of economic reasons, animal husbandry as part of mixed farming proved disadvantageous. Forage crops such as alfalfa were slow growing and expensive to cultivate. Above all, on a comparative basis with grain growing, mixed farming lacked profit potential. The initial investment in barns and silos, cost of forage crop seed, and the necessity for year-round hired help negated any advantages animal raising may have boasted.

HORSE RAISING ON THE PRAIRIES

The horse assumed an importance far beyond that of any other farm animal on the Prairies. Necessary for pulling the seeders, ploughs, harrows and other implements, its presence was taken for granted. Veterinary advancements, animal breeding and rearing improvements, and government policy all contributed to the development of extensive horse husbandry on the prairie dry belt.

Prairie horse breeding dates back to the 1880s. At the beginning of the decade defective eastern Canadian animals were shipped to Winnipeg or Brandon and sold to gullible immigrants at exorbitant prices. They died within a few weeks of purchase.[1] Yet as the decade progressed farmers achieved significant improvements in horse quality. In 1889 a leading farm journal observed that many high quality breeding stallions and mares had been imported - in Brandon alone one stable offered six Shire draft horses for sale. The introduction of high quality horses extended beyond Manitoba's boundaries. To improve equine quality, Qu'Appelle husbandmen secured the services of five stallions.[2] By 1890 a concerted effort to breed and raise draft horses had been made.

In 1907 the Saskatchewan Department of Agriculture reported that large numbers of Clydesdale and Percheron stallions with "the very best blood obtainable" made regular appearance at local fairs and exhibitions. A buoyant market for purebred sires that already existed could only blossom as settlement advanced.[3] Two years later the Department's dreams had been partially realized. High prices served as inducements to horse-breeding expansion and upgrading. The strong constitution and hardiness of Saskatchewan draft horses supposedly sent ripples of excitement through the spines of out-of-province stock breeders.[4] In 1920 Saskatchewan achieved its place in the sun. Producing 1600-pound draft horses for local grain growers, Saskatchewan horse breeders had transformed their industry into the largest operation in the Dominion. Even with their annual output of 100,000 animals, stock growers strained their resources to meet the provincial demand.[5] In terms of popularity the horse stood as the favourite of prairie animal husbandmen.

Saskatchewan horse breeders received national and international recognition for the quality of their product. At the 1920 Ontario Winter Fair in Guelph, Saskatchewan horses won five of the six awards offered for heavy draft horses including those of grand champion stallion and mare in each category. Breeders achieved similar successes at the International Livestock Exposition in Chicago. Judges bestowed upon provincial Clydesdale stallions the grand championship for two successive years - 1920 and 1921. Other awards in the Percheron category were forthcoming.[6] Experts had acknowledged the achievements of prairie horse breeders.

Triumph of the Clydesdale

The Clydesdale's supremacy as the leading prairie draft horse came about after a lengthy period of controversey and experimentation. At first husbandmen were uncertain whether the draft horse or the general purpose horse performed farm duties most efficiently. After grain growers had decided in the draft horse's favour, a period of comparing the attributes of various breeds commenced. From the outset of draft horse popularity to the time that the last challenger had fallen to the wayside, the Clydesdale maintained its hegemony.

Soon after prairie settlement began in earnest in the 1880s, a controversy emerged over the qualities farmers should seek in their horses. Arrayed on one side and led by John Gunion Rutherford were the advocates of the general duty horse. Containing no notable figures, their opponents, on the other hand, suggested that the heavy draft horse should be used as grain growing's mainstay. Advocates of the all-purpose horse stood for mixed farming while popularizers of the heavier beast concerned themselves with grain growing.

Rutherford led the campaign for a multi-duty animal. He wished to see a horse developed that could draw farm implements, haul grain to the elevator and pull a buggy. Unfortunately such an animal did not exist, necessitating crossbreeding. Rutherford advised husbandmen to mate ordinary brood mares with large, bony thoroughbred race horses to produce the desired beast. The new mongrel would supposedly perform all duties demanded of it as well as withstand climatic extremes.[7]

Yet the general purpose horse had its detractors, who claimed that mating the thoroughbred stallion to the mundane mare would prove so violent that both animals would be injured. Moreover, the offspring would be unacceptable - a horse capable of performing only light farm and occasional carriage duties but excelling at neither.[8] Since the bulk of farmwork necessitated the use of an animal that could propel seeders, ploughs and harrows from dawn until dusk, husbandmen required a horse especially suited to the task.[9] Only the draft horse and preferably the Clydesdale would fulfill these functions. The emergence of grain growing as the prairie mainstay resulted in increased draft horse acceptance.

At the turn of the century farmers considered the Clydesdale to be the ideal draft animal. To produce the desired horse, the farmer selected a purebred Clydesdale stallion. Moderate in size and weight, yet possessing heavily set bones and muscles for its dimensions, the stud was paired with a common variety mare.[10] Farmers found the offspring from this type of coupling to be the most desirable.

Despite challenges from the Percheron and Shire, the Clydesdale maintained its supremacy among draft horses during the first two decades of the 20th century. According to William J. Rutherford, Dean of the Saskatchewan College of Agriculture, the horse's popularity stemmed from its suitability for heavy farm labour. The Clydesdale derived much of its attractiveness as a result of its anatomy. Featuring solidly built muscles and bones, its compact body withstood prolonged periods of hauling heavy farm implements. Thick muscular thighs, strong legs "set squarely under the body - not out on the corners," and clearly defined knees all combined to provide long, high strides that enabled the animal to traverse muddy or undulating terrain that larger draft horses found impassable. Quality in a horse, asserted Rutherford, was far more important than sheer physical size.[11]

Popular in the United States because of a flirtation with the concept that somehow bigger was better, the Percheron likely made its first appearance on prairie farms owned by American settlers. This horse's adherents saw in it many advantages. Large, beefy, short-legged, and outweighing the Clydesdale by over 300 pounds, it was said to thrive when confronted with inclement weather, poor housing and heavy work.[12] Yet this breed displayed obvious shortcomings. Its short legs led to an imbalance when pulling machinery. Moreover, its weight advantage over the Clydesdale proved unnecessary for its lighter rival achieved similar results when drawing farm implements despite its smaller size.

Largest and heaviest of all, the Shire possessed most of the disadvantages of the Percheron. Similar in appearance to the Clydesdale, but weighing up to a ton, the Shire was differentiated from its smaller competitor by its beefier build and shorter legs covered with thick white fur. Its proponents boasted that their horse's size made it ideal for prairie operations; a Shire owner required fewer animals to work his farm than his Clydesdale-addicted neighbour. But even their enthusiasm waned when stallion prices were considered; the Shire stock breeder paid sums vastly in excess of his Clydesdale breeding competitors.[13] Like the Percheron, the Shire's short legs created problems in muddy terrain.

After having assessed multipurpose horses, farmers had opted for the draft variety by 1900. The Clydesdale possessed the characteristics best-suited for the grain growers' requirements and thus preponderated over the heavier and more unwieldy Percheron and Shire.

Advances in Treatment of Horse Diseases

Veterinarians identified and eliminated a multiplicity of horse disorders from 1880 to 1920. At first diagnosis was primitive and treatment rudimentary. Great strides in disease detection and elimination during the first two decades of the 20th century overrode the previous epoch's technological deficiencies. By 1925 grain growers were assured that most equine ailments other than glanders could be treated.

During the 19th century, diseases such as mange, equine influenza and constipation were identified and treatment prescribed. Veterinarians could also diagnose glanders but failed to establish its cause or develop an ameliorative. One of the 19th-century veterinary science's major contributions lay in the identification and treatment of mange. An infectious malady caused by the multiplication of a parasite, the disease thrived when husbandmen subjected their animals to unsanitary conditions. Victims displayed scaly and scabby skin. Equine sufferers shed epidermis and hair and left the animal with tender and itchy spots. Veterinarians prescribed cleanliness as an ideal treatment. If a farmer discovered the disorder, his horse dwelling required disinfection with sulphur and chloride of lime for two or three days. To rid animals of their affliction farmers concocted a liniment consisting of a variety of ingredients. A mixture containing animal glycerine, creosote, turpentine and oil of juniper was massaged into the horse's body twice daily for two days.[14] Regardless of the efficacy of this 19th-century ameliorative, the disease had at least been diagnosed.

Veterinarians made progress in recognizing and treating equine influenza. Farmers could be reasonably assured that weak horses exhibiting signs of fever and reduced appetite possessed the malady. Treatment was dependent upon the severity of the illness. If the case was mild husbandmen provided afflicted horses with eight daily doses of a gentian and ammonia tonic. More debilitating infections demanded stronger remedies. A twice daily stimulant comprised belladonna, opium, camphor, liquorice and molasses and would certainly induce equine hallucinations if not sprightliness! Husbandmen reserved the most potent palliative for cough symptoms. The prescribed ameliorative of belladonna, chloroform and alcohol certainly purged the ailment and perhaps the animal's internal organs.[15]

Common illnesses such as constipation attracted trained attention. Constipation frequently affected foals shortly after birth. Stimulant depletion in mare milk often led to offspring irregularity. An enema consisting of the injection of soap and water into the animal's anus rectified the situation.[16] This cure proved satisfactory even during the succeeding century.

A number of ailments remained 19th-century anomalies. Among them "dropsy of the brain" and "mad staggers" were most peculiar. "Dropsy of the brain" supposedly occurred after a horse had been subject to excitement from castration, stomach disease or food poisoning. Infected beasts exhibited an unnatural sleepiness, and/or lost balance. The horse breathed deeply, grunted regularly and tossed his head as if in great pain. To relieve the symptoms veterinarians recommended purgatives and enemas.[17] Animals infected with "mad staggers" displayed more violent symptoms, for inflammation of the brain led to total insanity. Husbandmen diagnosed the disorder early. Initially the horse manifested evidence of restlessness, irregular physical movements and violent trembling. As the disease progressed the animal became violent, ferocious, unco-ordinated and excitable. Effective treatment lay in purging the creature's brain and bowels. Veterinarians suggested a rather gruesome remedy. Farmers slit a horse's head and ears and forced it to bleed profusely. To prevent unconsciousness or even death, husbandmen made their incisions deftly and precisely. A strong enema containing aloes, castile soap, and caraways depurated the horse's bowels.[18] Such primitive diagnosis and treatment fortunately remained confined to the 19th century.

Glanders was one disease that 19th century veterinary science failed to treat. Infected animals could easily be identified by their dull, feverish and unhealthy appearance. As the disease progressed the beast's nose membrane took a purplish hue and emitted a thick mucous discharge. Treatment was optional. To retard the spread of this contagious disorder, American veterinarians suggested that afflicted horses be destroyed. Canadian specialists agreed although they mentioned that mild cases might be controlled by the usual purgative of camphor and arsenic.[19] Surely it proved nobler killing a horse trying to cure it rather than simply destroying it as a health precaution.

Disease diagnosis and amelioration improvements constitute the main accomplishments of the first two decades of 20th-century veterinary science. Treatment for mange, influenza, and pleuro-pneumonia took on an added complexity. With the exception of glanders, veterinarians made headway in the eradication of most serious horse disorders.

Veterinarians brought mange under control. Specialists such as John G. Rutherford recommended medication that soothed suffering horses. Farmers were urged to clip fur from mange-infected beasts and wash itchy areas with a mild soap. After a several hour lapse, they massaged a liniment consisting of heated sulphur, oil of tar and raw linseed oil onto the animal's body. Ten days later the treatment was repeated.[20] The new concoction provided greater soothing power than the 19th-century remedy.

Twentieth-century veterinarians refused to prescribe narcotics for treating equine influenza. A newly discovered anti-toxin totally eliminated it as a draft horse killer. For 25 cents per dose farmers could acquire the serum in 1919. Treatment entailed the injection of two cubic centimetres of the liquid in an initial application. Subsequent innoculation of four and six centimetres at two- and ten-day intervals terminated the regimen.[21] Vaccinated equine sufferers regained their sprightliness and vitality.

The discovery and treatment of pleuro-pneumonia was a major 20th-century veterinary accomplishment. Farmers attributed the disorder to an overexposure to cold weather or to an influenza aftermath. The victim exhibited a high temperature, poor appetite, quick pulse and cough. Rest was the best treatment. The farmer was urged to place his horse in a well-ventilated stall, massage strong liniment onto the animals sides, and cover it with a warm blanket. A tonic consisting of aromatic ammonia, sulphuric ether and raw linseed oil facilitated recovery.[22] A well-provided horse regained strength quickly.

Veterinarians made little headway in the fight against glanders. However, specialists devised an improved detection process called the mallein test. Veterinarians injected the substance and monitored increases in equine body temperature. Any tested horse registering a reading greater than 100° Fahrenheit possessed disease symptoms. Since no palliative had proven successful, veterinarians continued to suggest that all infected stock be eliminated.[23]

Veterinary science has indeed made great strides in eliminating equine disorders during 1880 to 1920. Although treatment often proved primitive and some prognosis dubious, 19th-century veterinary technology enabled farmers to diagnose horse ailments and deal with them in some fashion. Twentieth-century developments brought improved prognostications and palliatives. Only the elimination of glanders remained for the future.

Improvements in Horse Breeding

A major 1880-1920 accomplishment lay in the refinement of horse breeding to a point where the results from any mating combination could be predicted and guaranteed. Nineteenth-century veterinarians elucidated the general principles of breeding and described the care farmers should take of pregnant mares. Transforming horse breeding into a fine art, their 20th-century successors instructed stockmen on every aspect of equine reproduction.

Early prairie livestock specialists explained general breeding methods to husbandmen. In detail they tutored farmers on the principles of sire selection. Some hints on comforting pregnant mares were expounded, but stallion care received little attention.

John Gunion Rutherford's views on horse-breeding principles attracted the attention of early prairie farmers. He believed that each farmer ought to conceptualize the desired horse in accordance with the attributes of his selected mare and an available stallion. To obtain offspring bearing close semblance to the original female, both future parents required similar characteristics, but the danger of throwbacks always existed. To overcome the problem Rutherford urged husbandmen to use only purebred stallions. If a mutation was born it would possess similar qualities to the sire used. Ideal mating consisted of uniting a purebred stallion with a high quality mare.[24]

Veterinarians urged breeders to demand certain qualities in their mares and stallions. Weighing about 1350 pounds, the ideal mare possessed such attributes as heavy ribs, long quarters and round protrusion-free feet. Added assets included a medium-sized head and neck, and ears of similar proportions. The animal's gait also proved important. A mother's long, heavy, swinging strides could be handed down to her off-spring. The stallion combined the mare's characteristics along with certain desirable stud peculiarities. The *Nor'-West Farmer* asserted that "he should be.....more a horsey horse than she is a mare." Moreover, the stallion should be smaller and heavier built.[25] Mating properly proportioned animals resulted in the creation of satisfactory descendants.

Nineteenth-century veterinarians paid considerable attention to mare management during parturition. Leading husbandmen warned farmers that pregnant mares required special treatment - they should be worked, but not too strenuously. Overwork led to premature and difficult birth as well as multiplying the chances of abortion. On the other hand, an idle and overfed female became fat, underexercised and soft-muscled. Possessing similar inadequacies her foal would likely die before attaining maturity. Informed farmers provided their pregnant mares with a work load only two-thirds as strenuous as ordinary animals.[26]

Nineteenth-century achievements were basic. By 1900 farmers possessed knowledge of mare and stallion selection as well as mare management, although 20th-century husbandmen provided detailed information on all steps of horse breeding. Mare and stallion selection and care during mating became all-important. By 1920 a comprehensive knowledge on the topic existed. J.G. Rutherford's 19th-century theories remained relevant.

Farmers were advised to look for certain definite features when purchasing breeding stock. The ideal animal for beginners was not a purebred, but a grade mare. Experts advised farmers to procure mares varying from four to six years of age, particularly those that had gone through prior pregnancies. A medium weight beast with sound bone and muscle conformation proved most likely to procreate easily.[27] On the other hand, the ideal stallion was a purebred. Weighing 1800 pounds or more, it featured "a wide, deep, short-backed body, set on properly placed limbs of medium length, with clean joints, hard, flinty bone and large, sound feet." It walked freely with a high, springy stride. Failure to select breeding animals carefully ended in disaster. Such faults in mares or stallions as small size, poor conformation, short ribs, weak loins, drooping rumps, or poorly set limbs resulted in the birth of inferior draft horses unsuitable for any kind of labour.[28]

Twentieth-century husbandmen upgraded mare management methodology. Experts reasserted an earlier claim that mares could be worked while pregnant. However, they warned that difficult terrain such as deep snow or mud should be avoided and the animal freed from hauling heavy loads. Farmers should rest their beasts during the final ten days of pregnancy. A clean well-ventilated box bordering a sheltered yard provided the mare with rest during the prelude to foaling.[29] Veterinarians discovered feeding as a major variable in equine pregnancy success. John G. Rutherford suggested that the mare's diet "should be generous but judicious." Dry foods caused constipation while stimulants tended to foment diarrhea. Coarse, indigestible, sour, musty or frozen foods were best omitted while flax seed, oil cake, and oil meal required cautious rationing. An ideal diet consisted of good hay, small amounts of oats, and bran twice daily, soft feed at night, a regular salt allowance and plenty of tepid water.[30] A limited work load and suitable diet permitted the mare to foal successfully.

Leading husbandmen placed increased emphasis on stallion care. During the summer breeding season stockmen took measures to maintain their stud's beauty and sexual prowess. To obtain the maximum semen flow from their beasts, husbandmen provided a ration consisting of three parts oats and one part bran. For each hundred pounds of a stallion's total weight, it received one pound of feed daily.[31] Veterinarians urged proper maintenance of a stud's sexual organs. Applied to the genitals, soap or a mild antiseptic rendered the horse fit for service. To avoid the spread of disease, wise stock growers refrained from using their valuable studs on questionable mares. During the actual breeding process, veterinarians advised farmers to practise restraint. A two-year-old stallion should mate with no more than eight or ten mares per season, while a strong three-year-old could handle 20-30 females and a four-year-old, up to 50. While mating, the stallion needed protection from kicking females. Farmers tied violent mares in a manner that did not hinder the copulation process; husbandmen provided stallions with complete freedom to impregnate their recipients.[32] Farmers who heeded veterinary advice could breed their stallions successfully.

Late 19th-century technology had provided farmers with information to enable them to select the ideal types of animals for breeding. Twentieth-century methodology provided in-depth, step-by-step information to the newcomer.

Improvements in Care and Feeding of Horses

Horse raising emerged from small 19th-century beginnings to an exacting 20th-century science. Before 1900, prairie stockmen had developed a primitive but workable methodology. By 1920 veterinarians had dwelt extensively on such topics as foal raising, workhorse feeding, and wintering.

Nineteenth-century stockmen devoted considerable effort to improving foal upbringing. After the animal had arrived in a healthy state it required maternal care for a four-month minimum. Generally a mare pawed her offspring gently. After a difficult birth an irritable mare might demand temporary separation from her foal. John G. Rutherford recommended that the mare and offspring be placed at opposite ends of a stall, bisected by a gate or small hurdle. Then a process of concilation between the two animals could begin. For the first four months of the foal's life, its mother's milk sustained the young animal. The mare could be milked and the fluid carefully fed if the foal proved too weak to suckle.[33] In this fashion the young horse was nurtured beyond the initial critical period.

At the age of four months veterinarians advised stockmen to separate the foal from its mother. Eating from the maternal feed box, it consumed a ration consisting of large quantities of oats, moderate amounts of bran, and the occasional portion of crushed oil cake. Housed in loose boxes rather than stalls, animals possessed the opportunity to move freely and develop their muscles.[34] Soon after young horses began a useful life in man's service.

Before the turn of the century prairie stockmen refined the fundamentals of horse training. Drills could commence within one year of the animal's birth. The first exercise involved leading and hitching the animal. During the second year, first-year drills were repeated since the horse's muscular structure remained relatively undeveloped. By the third year training could develop in earnest. It now became appropriate to introduce the animal to the harness. A third year of light and sparing labour increased the horse's utility as a useful drawer of agricultural implements.[35]

Nineteenth-century husbandmen developed techniques for feeding horses in general, but failed to differentiate between idle and working animals. Oats and hay constituted the mainstay of an equine diet. The average animal could be induced to consume 20 pounds of feed daily. Indian corn and bran could supplement normal rations. Experts advised farmers to provide their animals with five pounds of feed in the morning, five at noon and the remainder at night,[36] but their suggestions were imprecise and of limited use.

To raise horses successfully veterinarians needed to devise wintering techniques. Early prairie husbandmen responded by developing a basic methodology. Particular attention was focused on wintering colts. Farmers placed young animals untied in roomy stables equipped with individual feed boxes. Ideally these structures proved sufficiently commodious to permit free horse movement.[37] Experts profferred no advice for wintering mature animals, nor did they devote attention to horse shed ventilation.

The first two decades of the 20th century witnessed significant progress in the process of raising horses. In the 19th century a workable methodology had been developed for foal raising and horse training, although problems continued to plague farmers involved in feeding and barn construction. After 1900, however, the raising, training and feeding of horses was elevated to the level of a science.

Stockmen refined existent foal-care knowledge. Experts such as John G. Rutherford cautioned farmers to consider cleanliness a prerequisite to satisfactory animal upbringing. After birth, horses required clean, dry bedding in their stalls.[38] Leading veterinarians considered exercise to be beneficial to colts. Upon learning to walk, young draft horses should be pastured with their mothers.[39] Another function, liquid drinking, did not come instinctively. At an early age farmers taught their colts to consume life-providing waters.[40] By ensuring the colts' cleanliness, exercise and water intake, husbandmen provided for the successful maturation of their animals.

Haphazard horse diets disappeared as past relics by 1920. A new technology based on the following three premises was formulated: i) feed regularly, ii) vary the ration as much as possible, iii) never feed more than horses will voluntarily consume. Husbandmen developed a winter diet for idle draft animals. Comprised of oats, wheat and barley straw, plus a maximum of six pounds of roots, the ration was ladled in three increments - one-fourth in the morning and noon, the remainder at night. Provided before meals, tepid water completed each equine adjunct.[41] Veterinarians recommended a substantially different summer diet for labouring horses. Half gallon oat installments at each meal preceded by water and supplemented by an evening hay ration enabled beats to perform effectively.[42] By 1921 veterinarians had discovered that alfalfa provided ideal feed[43] but its high cost limited hopes of popularity. Horse dieting had been transformed into a science.

Needed for wintering horses, barn structures received added attention. All stables required good ventilation, airiness and sufficient light. Veterinarians described the ideal horse barn as boasting a solid dry floor sloping slightly to the rear, wide doors and slat-bottomed mangers.[44] To ensure horse-rearing success, cleanliness became mandatory although husbandmen did not delve into specific wintering problems.

By 1920 horse-rearing had become sophisticated and complex. In virtually every area, except perhaps that of wintering, detailed knowledge had been disseminated to prairie stockmen.

Federal and Provincial Initiatives to Promote Horse Raising

Federal and provincial governments took active steps to encourage prairie horse breeding. At first the federal government confined its activities to disease control. A shortage of draft horses on prairie farms during World War I encouraged the Dominion to improve breeding stock. Prairie governments in general and Saskatchewan in particular made concerted efforts to better the quality and numbers in animals.

A major facet of Dominion policy lay in the prevention of epidemics. By 1896 the Customs Department enforced regulations governing horse importation. The law required all horses entering Canada from the United States, Great Britain or Continental Europe to be accompanied by signed health certificates from qualified veterinarians. Authorities demanded that these documents indicate animals had also been secured from epidemic-free regions.[45] Rigid inspection procedures ensured that certificates were genuine. Twentieth-century regulations proved more stringent. The federal government drew contingency plans to deal with epidemics such as horse mange. When a plague took hold in the Red Deer Valley in 1903, the Minister of Agriculture quarantined the area and prohibited horse removal from the specified zone. Inspectors could order afflicted animals treated and their owners billed for the services. Moreover, authorities banned outside horses from establishing contact with bovine sufferers in the cordoned area.[46] Thoroughness had been the hallmark of Dominion disease control.

A prairie draft horse shortage led the federal government to announce an assistance policy to breeders in 1916. To participate, farmers formed a breeders' club, hired a purebred stallion and guaranteed the stallion owner a number of mares. The club collected service fees from its members and paid one-third of the amount to the stallion owner at the end of the service season. As each mare foaled, the club disbursed the remaining two-thirds to the sire's proprietor. At the mating season's termination the stallion owner furnished the Livestock Branch with a certified account book and received a cheque for one-quarter of total service fees. The Livestock Branch forwarded a similar sum to the club.[47] In 1920 the Department confirmed the programme's efficacy:

> This policy is slowly but surely bringing about the results for which it was inaugurated, namely to make the keeping of a good stallion a paying proposition to the owner and at the same time to enable clubs to obtain the services of such a stallion at a reasonable service fee.[48]

Federal government encouragement of horse breeding had proven as successful as its disease control programme.

Among the projects undertaken by the Saskatchewan government to encourage horse breeding, the sponsorship of spring stallion sows was one of the most important. According to Alfred F. Mantle, Deputy Minister of Agriculture, before World War I, stallion shows achieved certain objectives. Farmers customarily purchased horses during the spring months. Competition among a district's leading stallions led to increased grain-grower knowledge. Listening to a judge explain stallion attributes could only persuade farmers to breed for certain desirable qualities. Moreover, the farmer was able to closely examine an entire field of horses and ascertain which stallion would mate successfully with his mares.[49] These features made stallion shows desirable.

A typical stallion show was held at Oxbow, Saskatchewan, on 7 April 1911. Only stallions available for local service could enter the show and these required a $5 deposit. Husbandmen placed animals in several categories, but draft horses predominated. In the main category, Class I, judges awarded prizes to deserving Clydesdales and Shires. For a stallion foaled in 1907, a first prize of $15 and second and third prizes of $10 and $15, respectively, awaited stud proprietors. For stallions foaled in 1908 awards of $12, $8 and $4 existed. The grand champion of the category could earn an additional $5. Belgians and Percherons could win similar sums in Class II.[50] Prospects of collecting stud service fees induced breeders to enter the competition.

Agricultural extension lectures and Better Farming Trains imparted horse-rearing knowledge to Saskatchewan farmers. Before World War I the Saskatchewan government stressed lectures. Beginning in 1907 and continuing to 1914 such prominent individuals as A.F. Mantle, W.J. Rutherford and Duncan Anderson (a leading eastern Canadian horseman) spoke on draft horse breeding, feeding and judging.[51] After the war, the government altered its tactics. It now decided that Better Farming Trains bore greater relevance to its objectives. In 1920 the train touring the province contained displays of choice draft horses. Two years later the Department of Agriculture set up a similar mobile exhibition. The programme reached its apex in 1925 with the appearance of the Better Livestock Train, a travelling exhibition boasting one complete boxcar with all types of choice draft sires and mares.[52] Saskatchewan governmental objectives consisted of informing farmers of ideal horse types and elucidating rearing and breeding methods.

The passage of laws regulating stallion usage completed the Saskatchewan government's programme for improved horse breeding and rearing. As early as 1903 the North-West Territories had passed a Horse Breeders' Act requiring the registration of all breeding horses and demanding a $5 fee for all purebred and $10 for grade and scrub stallions.[53] By 1907 the Province of Saskatchewan had amended the territorial act by making it compulsory for all stockmen to register grade stallions and providing penalties for failure to comply.[54] The pinnacle of stallion legislation was achieved in 1912 when a new Horse Breeders' Act came into effect. The new law re-asserted 1903 registration procedures but stiffened existing provisions. Under the new legislation it became unlawful to mate scrub, grade or cross-bred stallions to mares for the purpose of profit in specially designated regions. Moreover, any purebred stallion could be barred from breeding if inspectors discovered disease or physical deformity.[55] Saskatchewan's lawmakers were determined to improve the quality of the province's horses.

Conclusion

The evidence shows that horse breeding and rearing, particularly of the draft horse variety, became important on the Prairies in general and Saskatchewan in particular because of this animal's role in grain growing. Husbandmen refined methodologies to combat disease and refine breeding practices. Federal and Saskatchewan governments assisted in the endeavour to improve animal quality. By 1920 Saskatchewan was the leader in stock breeding in Canada.

ANIMAL HUSBANDRY IN THE QU'APPELLE VALLEY

The Qu'Appelle Valley is a narrow but verdant and well-watered basin that traverses the flat plains of Southern Saskatchewan from the lakes north of Regina to the southeast corner of the province. Geographically it is like an elongated oasis, offering good shelter, wooded bluffs and convenient streams in an otherwise dry-land agricultural region. But despite the potential of the Qu'Appelle to support an extensive mixed-farming system, even here animal husbandry was unable to supplant wheat growing as the major economic activity. As in the rest of Southern Saskatchewan horse breeding was devoted solely to the rearing of work animals to provide motive power for field machinery. Swine, dairy and beef cattle played only a secondary role in the valley's economy and on many farms these animals and poultry were kept only as a part of a hobby industry.

The failure of mixed farming to capture the imagination of the Qu'Appelle Valley farmer was certainly not due to the publicity given the region by the popular local (farm) press during the settlement period. *The Qu'Appelle Progress* embarked on an incessant campaign to tout the virtues of the valley as an ideal multiproducts region. The south floor and wall of the valley were heavily populated with poplar and approximated the parkland hundreds of miles to the north.[1] Black loam soils and easy access to naturally stored water made the valley floor ideal for grain growing, while the northern bluffs and low hills offered ideal stock shelter against the prevailing northwest winds.[2] Moreover, the succulent prairie grasses of the north slope offered a natural nourishing feed without requiring the same land-intensive approach demanded by the sparse Alberta rangelands to the west.[3]

By 1897 the *Progress* was hailing its valley as the best livestock-rearing area between the Red River and the Rockey Mountain foothills. But this mixed-farming Garden of Eden failed to materialize.[4] The data presented in the Dominion and provincial census returns, inconsistent as they may be, still illustrate a reliance on grain crops at the expense of a viable animal industry even in the Qu'Appelle Valley.

Statistical Comparisons of the Qu'Appelle Valley and Other Saskatchewan Regions

Although the data is uneven and the information base constantly changes, the North-West Territories, Saskatchewan and Canada census returns provide a rough indication of the role of animal husbandry in the Qu'Appelle Valley and its relation to grain growing. Moreover, returns permit comparisons to be made between the livestock industry of the region and those of adjoining districts. While the material can only furnish a descriptive analysis, such use cannot unfortunately lend itself to quantifiction, as Dominion authorities periodically re-drew the federal electoral constituencies for which the statistics were collected. Within the constantly changing boundaries, information on individual townships cannot readily be isolated as census-takers only began collecting such data in 1921. Statistics derived from census returns therefore reflect a continually changing information base as well as constituency boundaries that frequently include areas remote from the Qu'Appelle Valley's perimeters.

Based upon vague and only roughly definable areas in 1885, census returns six years later were collected for each federal constituency in the Northwest. Enumerators divided what now constitutes the Wheat Province into two districts - Assiniboia and Saskatchewan. Embracing an area latitudinally similar to Regina, Assiniboia contained subdivisions of Broadview, Qu'Appelle and Regina, Moose Jaw, Swift Current, Maple Creek and Medicine Hat. Carrot River, Prince Albert and Battleford made up Saskatchewan. Since specific boundaries are not delineated in the 1885 report it is difficult to pinpoint the perimeters of each district. We can only entertain the possibility that the survey encompassed a region with a western extremity of Regina, an eastern boundary at Indian Head, a northern border beyond the Qu'Appelle River and an unknown southern periphery.

The establishment of the first electoral districts in 1887 make the Qu'Appelle Valley easier to identify in the 1891 Census of Canada. Assiniboia was divided into two constituencies - Assiniboia East and West with a boundary east of Regina. Two sections of Assiniboia East, Qu'Appelle and Broadview, retained an undefined bisector. Only the former is considered in this study (Fig. 15). Beginning with undefined boundaries in 1885 enumerators began taking data from political constituencies six years later - a practice that continued until 1921.

Enumerators based their 1906-16 findings upon continually changing constituencies. The 1902 electoral districts constituted the divisions for the 1906 *Census of the Northwest Provinces*. The district under scrutiny was divided into two regions - Qu'Appelle and Assiniboia East. Possessing an important part of the Qu'Appelle Valley embracing Indian Head, Fort Qu'Appelle and Qu'Appelle, the former also received a southeastern slice of Assiniboia West (Fig. 16).[5] Further redistribution occurred in 1906 and was reflected in the 1911 *Census of Canada*. Instead of preserving the previous north-south periphery, dividing eastern and western portions of the valley, the Qu'Appelle River became a north-south bisector. With the inclusion of both Saltcoats and Qu'Appelle, a study of the western portion of the valley reflects the inevitable distortions created by the returns from the eastern mixed-farming region. The 1914 redistribution further exacerbated the situation, for the northern portion of the valley, namely Saltcoats, received a northeastern section - a wooded area where mixed farming was prevalent (Figs. 17 and 18). The 1916 *Census of the Prairie Provinces* was the last statistical survey to use constituency boundaries.

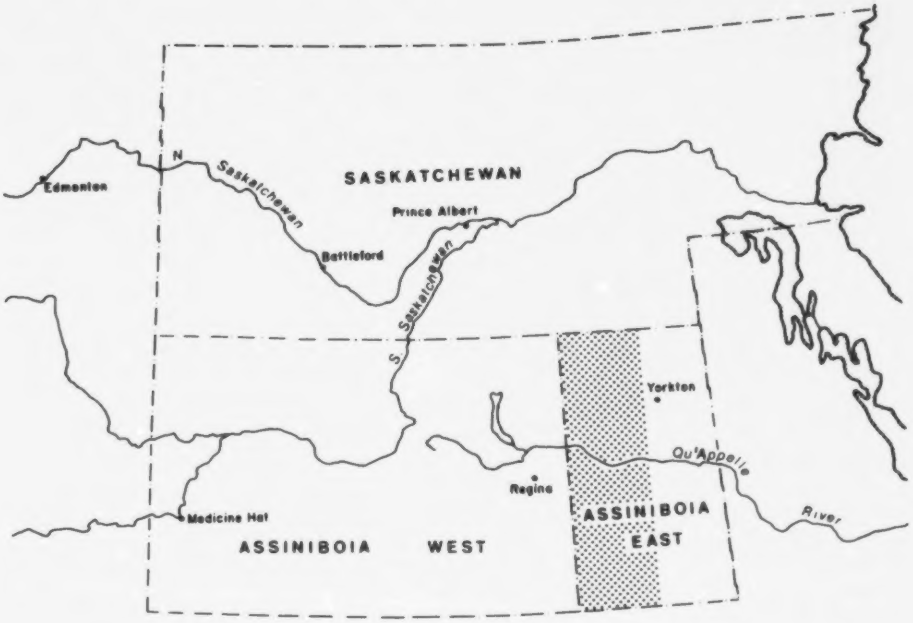
SASKATCHEWAN
Edmonton
N Saskatchewan
Prince Albert
Battleford
S. Saskatchewan
Yorkton
Qu'Appelle River
Regina
Medicine Hat
ASSINIBOIA WEST
ASSINIBOIA EAST

Figure 15. Electoral districts 1887. Shaded area represents most probable boundaries of the Qu'Appelle census division in 1891.

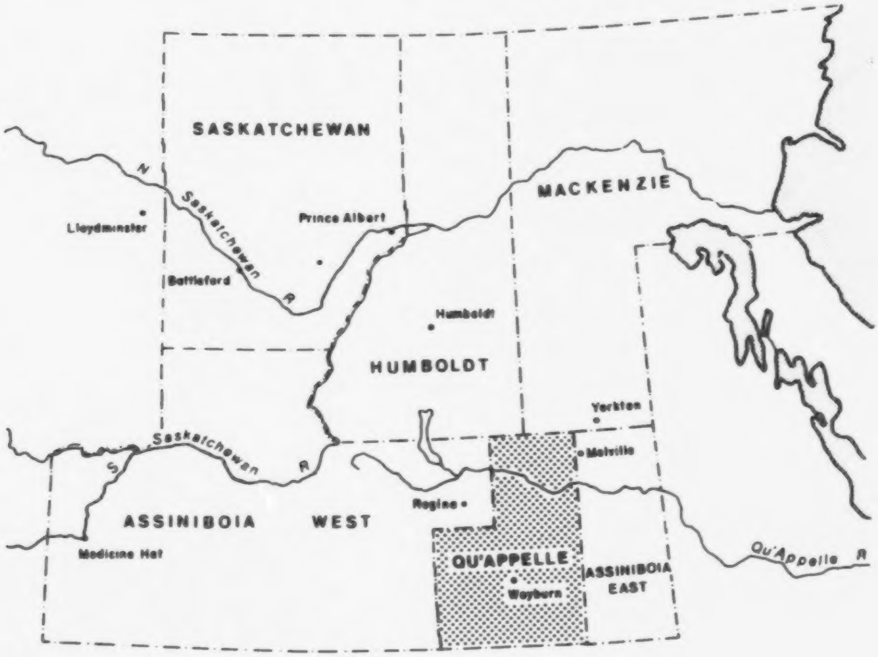
SASKATCHEWAN
N Saskatchewan R
Lloydminster
Prince Albert
Battleford
MACKENZIE
Humboldt
HUMBOLDT
Yorkton
Melville
S Saskatchewan R
Regina
ASSINIBOIA WEST
Medicine Hat
QU'APPELLE
Weyburn
ASSINIBOIA EAST
Qu'Appelle R

Figure 16. Electoral districts 1902. Shaded area represents district studied.

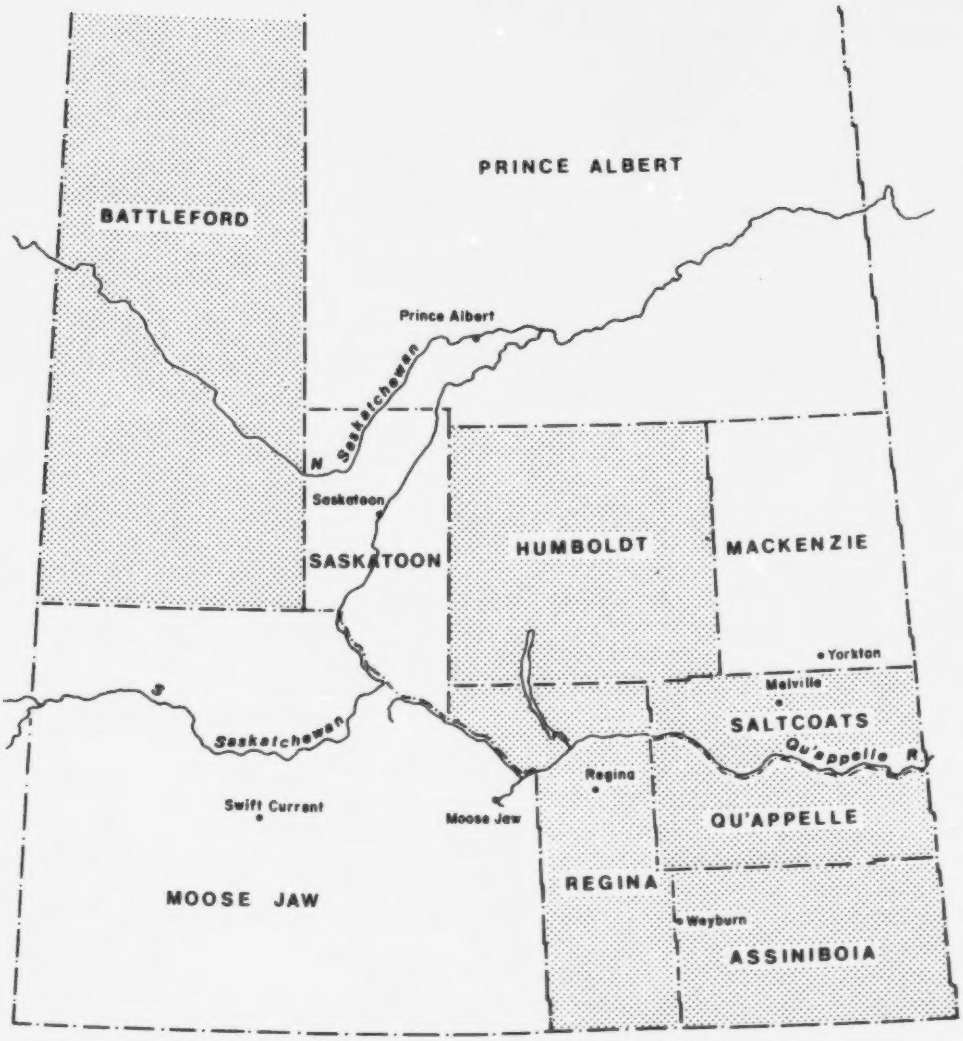
PRINCE ALBERT
BATTLEFORD
Prince Albert
N Saskatchewan
Saskatoon
SASKATOON
HUMBOLDT
MACKENZIE
Yorkton
Melville
SALTCOATS
Qu'appelle R
S
Saskatchewan
Regina
Swift Current
Moose Jaw
QU'APPELLE
REGINA
MOOSE JAW
Weyburn
ASSINIBOIA

Figure 17. Electoral districts 1906.

During the 1921 Census the federal government discarded the old borders and replaced them with permanent census districts. Division Number 6 became significant because it embraced an area on both sides of the Qu'Appelle River, extended westward as far as Moose Jaw and eastward as far as Wolseley. Division Number 5, a distinct eastern mixed-farming extension of the Qu'Appelle Valley, became a separate region. Now divided into individual districts the former parkland regions could not weigh Qu'Appelle Valley data in favour of animal husbandry. The 1921 and 1926 tabulations more truly reflected the state of livestock rearing in the Qu'Appelle Valley (Fig. 19).

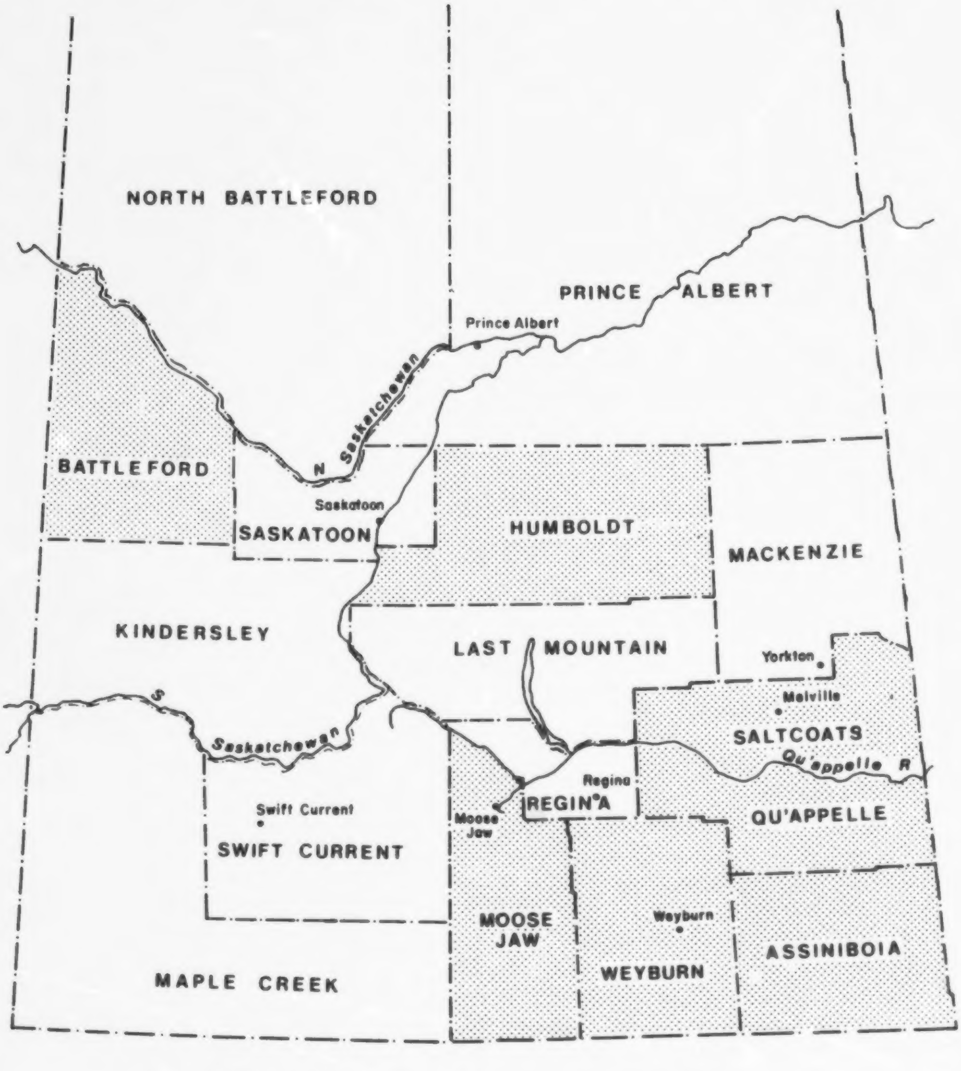
NORTH BATTLEFORD
PRINCE ALBERT
Prince Albert
N Saskatchewan
BATTLEFORD
Saskatoon
SASKATOON
HUMBOLDT
MACKENZIE
KINDERSLEY
LAST MOUNTAIN
Yorkton
Melville
S Saskatchewan
SALTCOATS
Qu'appelle R
Regina
REGINA
Moose Jaw
Swift Current
SWIFT CURRENT
QU'APPELLE
MOOSE JAW
Weyburn
WEYBURN
ASSINIBOIA
MAPLE CREEK

Figure 18. Electoral districts 1914.

Comparisons with animal industry in other grain-growing and mixed-farming regions of Saskatchewan illuminate the status of the Qu'Appelle Valley as a livestock rearer in the provincial sphere. Since the Qu'Appelle Valley became renowned early in its history as a wheat producer, a comparison of its animal industry with that of the Regina Plains and southeastern Saskatchewan grainfields should shed further light on the role of animal husbandry in the valley. Like the data from the Qu'Appelle Valley, Regina Plains statistics can only be secured from a region with shifting perimeters. The 1911 information is taken from the federal constituency of Regina, a narrow and rectangular entity that extends from the United States boundary to a point parallel with the northern extremity of Saltcoats (Fig. 17). In 1916 the Regina Plains encompassed Moose Jaw and Weyburn, but excluded Regina, now a predominantly urban riding (Fig. 18). The most drastic alteration occurred in 1921 when the region's focal point, Regina and its surrounding area, was excluded because as Census District 6, they now reflected the agriculture of the Qu'Appelle Valley. Lying to the immediate west and south, Divisions 7 and 2 now made up the district (Fig. 19). On the other hand, a relatively constant statistical base can be established for southeastern Saskatchewan. Listed by census-

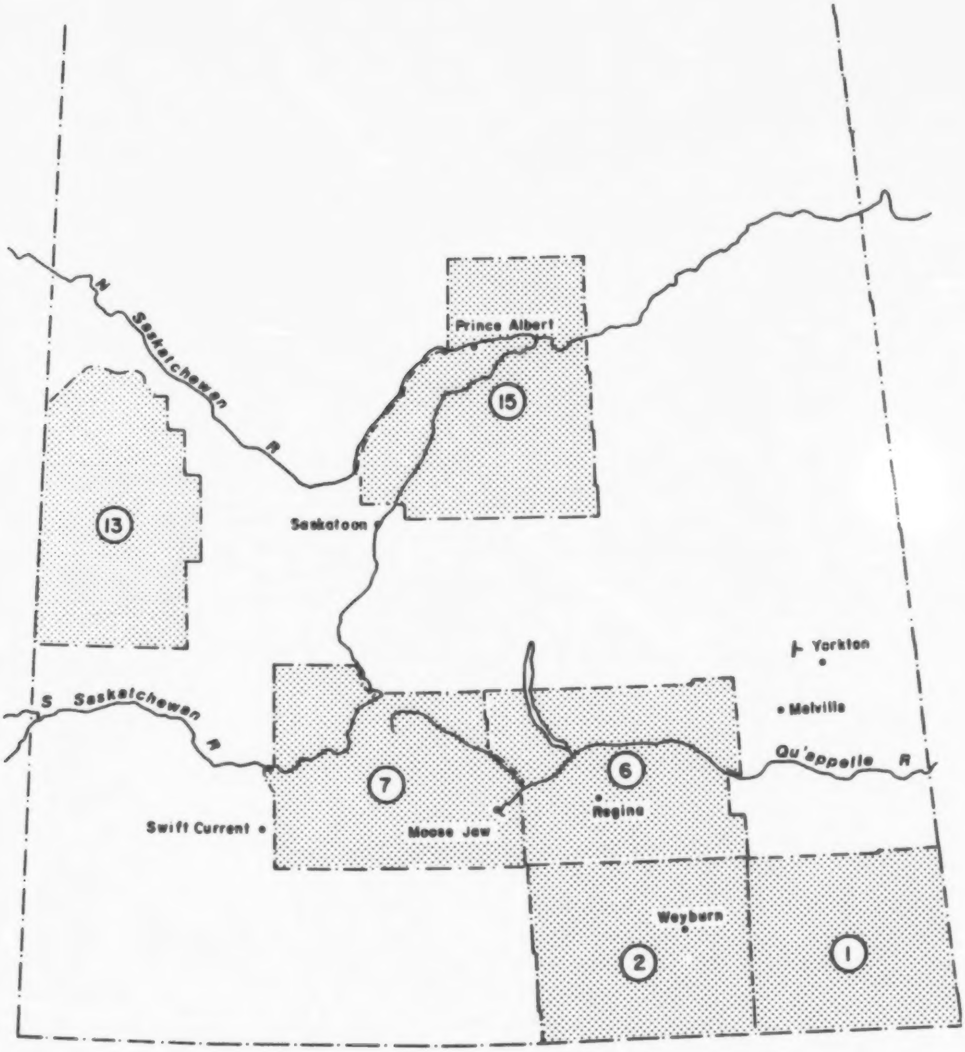
N Saskatchewan R
Prince Albert
15
13
Saskatoon
Yorkton
Melville
S Saskatchewan R
Qu'appelle R
7
6
Regina
Swift Current
Moose Jaw
Weyburn
2
1

Figure 19. Census divisions 1922.

as Assiniboia in 1911 and 1916 and five years later as Census Division 1, the district lay in the extreme southeastern part of the province and bordered the United States and Manitoba (see Figs. 16-19 for the region's exact boundaries). When contrasted with the dry-land regions of the Regina Plains and Assiniboia, a true picture of Qu'Appelle Valley animal husbandry as an ancillary industry emerges.

Comparisons between the Qu'Appelle Valley and several mixed-farming districts inform us how closely valley animal industry stood in relation to the parkland regions. Representing the latter are Battleford and Humboldt. Periodical boundary realignments produce the same distortions here as in other Saskatchewan constituencies. Possessing the Alberta boundary as a western extremity, Battleford was bisected by the North Saskatchewan River for the 1911 Census (Fig. 17). Five years later enumerators for the *Census of the North West Provinces* listed data for a constituency drastically pared in size - a riding that had lost its southern part and extended northward only to the North Saskatchewan River (Fig. 18). In 1921 another boundary change occurred, but the new Census Division 13 exhibited boundaries roughly equivalent to those from which the 1916 data had been tabulated (Fig. 19). Humboldt suffered a worse fate at the hands of Ottawa authorities. Enumerators in 1911 collected statistics for a square-shaped district north of Regina and east of Saskatoon (Fig. 17). Five years later its southern half had been deleted and a western segment added (Fig. 18). When the federal government finally established permanent census divisions, the new District 15 retained the rectangular shape of its predecessor but was placed somewhat to the north of the old Humboldt riding (Fig. 19). Despite the impossibility of securing an even data base for Battleford and Humboldt, a comparison of these two parkland regions with Qu'Appelle still yields meaningful information on the state of valley livestock rearing.

When statistics from census reports are tabulated and compensation is made for inaccuracies caused by constant contituency realignment, the place of animal husbandry in the Qu'Appelle in relation to livestock rearing in other parts of the province becomes clear. The average number of swine, and milch and beef cattle per farm in areas adjacent to the valley exceeded those in such grain-growing areas as the Regina Plains. Yet averages in the Qu'Appelle Valley fall somewhat below those achieved in the parklands. As a supplementary industry to grain growing, animal husbandry in the Qu'Appelle Valley stands about halfway between provincial minimum and maximum figures.

Dairy Farming in the Qu'Appelle Valley

Though widely promoted by local exponents, dairying failed to erect a solid foundation in the valley. The weekly press considered Qu'Appelle Valley dairying to be axiomatic with rural prosperity. In 1898 the *Qu'Appelle Vidette* declared that "the greater the diversity of production within a country the less liable is that country to suffer from hard times." Dairying proved eminently suitable as a means of farm diversification. Individuals elaborated upon the press theme. W.R. Motherwell claimed that dairying would become both practical and profitable if farmers seeded bromegrass. This fast-growing legume supposedly permitted cattle to pasture for long periods and thus produce great quantities of milk.[6] Another farmer, L.G. Bell, advocated winter dairying to transform the industry into a profit-maker. Despite high costs of winter feeding, substantial returns would foster the enterprise's growth.[7] Agricultural societies aided the educational process by providing lectures to husbandmen. In 1912 the secretary of the Fort Qu'Appelle Agricultural Society proudly announced that J.W. Mitchell, a leading dairyist, had spoken to his organization's largest assemblage - 127 people.[8] Nearby Whitewood could boast such guests as Angus Mackay elucidating dairying principles.[9] Yet, despite press, as well as individual and agricultural society efforts, propaganda remained ineffectual.

Statistics point to the failure of large-scale dairying in the Qu'Appelle Valley. Out of 15 creameries financially assisted by the Dominion Department of Agriculture in the North-West Territories in 1896, only four were in operation nine years later. Only the Qu'Appelle Creamery functioned in 1905, others at Grenfell, Whitewood, Wolseley and Indian Head had succumbed to financial woes.[10] Grenfell operated only during 1897-1903. Whitewood endured precariously for a similar period. Plants at Indian Head and Wolseley failed after a mere three-year stint in butter production.[11] Surprisingly, the Qu'Appelle Creamery survived despite a general lack of interest and incredible mismanagement.

Nonetheless, the Qu'Appelle Creamery could hardly be described as an outstanding success. Constructed during the 1880s, its owners placed the operation in jeopardy at the outset. Situated on low-lying ground in close proximity to a slough, its waste discharge was so maladorous that many suppliers refrained from patronizing the facility.[12] Moreover, its production figures were slight. In 1897 the creamery yielded only $5200 from butter while the region's wheat income grossed $131,000.[13] Two years later butter value had increased only by $200.[14] The 20th century brought little prosperity to the facility. Fluctuating wildly from $1815.93 in 1907 to $23,402.75 four years later, gross returns could not compare with the steady $11,000 or $16,000 profits accrued by such creameries as Tantallon or the even higher sums realized by Regina, Melfort, Langenburg and Birch Hills. In 1912 it closed its books.[15]

Although slight, statistics indicted that the Qu'Appelle Valley stood ahead of other dry-land farming regions and almost abreast of parkland districts in terms of dairying in Saskatchewan throughout the 1911-26 period.[16] Farms in the census districts embracing the Qu'Appelle Valley reported an average of 1.25 milch cows per farm in 1885 and 3.4 six years later. This latter figure suggests that at least a few farmers made their living by raising large numbers of stock during the 1890s. Reduced by 1 and 1.2 cows, respectively, to eliminate the influence of eastern parkland townships, Qu'Appelle Valley averages of 2.28 in 1911 and 3.7 in 1916 remained respectable within the provincial context. These figures easily exceeded the 1.86

and 2.62 1911 and 1916 totals that the Regina Plains could muster. Qu'Appelle figures for 1921 and 1926 require no correction. Tabulated from the totals provided in the 1921 *Canada Census* and the 1926 *Census of Saskatchewan*, these numbers easily exceed those of the Regina Plains. Moreover, Qu'Appelle figures come close to those listed for the mixed-farming regions of Battleford and Humboldt (Table 1). During one year, 1926, the Qu'Appelle Valley average of 3.8 milch cows per farm exceeded Battleford's 3.24 and Humboldt's 3.78 (Table 2).[17] Certainly small in scope, but significant in comparison to other districts, Qu'Appelle Valley dairying remained constant throughout the settlement era and provided supplementary incomes to a small number of farmers.

Table 1. Total Number of Farms in Selected Saskatchewan Regions, 1911-26
(Data in all tables derived from federal census returns, 1911-26)

Year	Qu'Appelle Valley	Regina Plains	Assiniboia	Battleford	Humboldt
1911	10,224	7,710	7,425	13,247	13,217
1916	9,110	11,406	4,822	5,710	7,949
1921	7,497	15,397	5,679	6,738	10,011
1926	7,978	14,344	5,616	6,826	10,238

Qu'Appelle Valley - 1887, 1891 farms; 1891, 1231 farms.

Table 2. Average Number of Milch Cows in Selected Saskatchewan Regions, 1911-26

Year		Qu'Appelle Valley	Regina Plains	Assiniboia	Battleford	Humboldt
1911	Tot.	33,492	14,377	18,220	14,728	25,627
	Avg.	3.28	1.86	2.45	1.11	1.93
1916	Tot.	44,618	29,959	20,722	20,154	28,467
	Avg.	4.9	2.62	4.3	3.52	3.58
1921	Tot.	25,155	43,192	25,512	24,026	39,206
	Avg.	3.36	2.8	4.5	3.57	3.91
1926	Tot.	30,332	50,306	30.078	22,125	38,730
	Avg.	3.8	3.5	5.4	3.24	3.78

Qu'Appelle Valley - 1877, 2364 cows, 1.25 avg.; 1891, 4916 cows, 3.4 avg.

Extent of Mixed Farming in the Qu'Appelle Valley

Agriculturalists promoted swine and beef cattle husbandry as ideal industries for the Qu'Appelle Valley. The weekly press advised farmers to raise beef cattle and ration them ensilage for profitable returns.[18] Husbandmen turned their attention to swine. Writing in the *Nor'-West Farmer*, Edwin J. Brooks of Qu'Appelle asserted that swine shielded farmers against crop failure. When smut and frost limited a farmer's total grian shipment, the "good-for-nothing wheat" could be fed to hogs and a total income loss averted.[19] Agricultural societies complemented press efforts. Lecturers such as George Harcourt informed farmers on the reasons for selecting purebred sires for cattle breeding. Farmer's institutes attracted attendance in the 40-50 range,[20] while agricultural societies promoted animal husbandry by holding exhibits. In 1887 the South Qu'Appelle Agricultural Society offered awards for best purebred and grade bulls, rams, ewes, boars and sows. First prizes varied from $8 for purebred Durham bulls to $5 for best ewe or ram lambs. Second prizes ranged from $3 to $5 for all categories.[21] By 1912, however, animal husbandry, even in the heart of the valley at Fort Qu'Appelle, had waned. Directors of the organization at that location could report no stock-judging competition, only a seed fair.[22]

Throughout the settlement period the average numbers of beef cattle per farm in the Qu'Appelle Valley remained relatively constant between 5.31 and 7.07 while other regions witnessed increases and declines. As early as 1891 the Qu'Appelle Valley registered an averge of 7.02 cattle per farm - an indication that a small supplementary cattle-raising industry had emerged on the sheltered terrain watered by the Qu'Appelle River and its tributaries. Qu'Appelle Valley cattle raising easily exceeded the averages of the Regina Plains. Dry-land figures of 3.5 cattle per farm could not compare with the substantially higher figures of the Qu'Appelle watershed. Before 1921 even Battleford and Humboldt averages remained lower than that of the valley. Only then did the mixed-farming regions overtake Qu'Appelle. Battleford averages of 7.59 in 1921, 5.15in 1926 and Humboldt figures of 7.84 and 8.89 for the same years exceeded Qu'Appelle's 6.09 and 5.31. Surprisingly, Assiniboia, a major grain-growing region, boasted the highest averages of all (Table 3). The Qu'Appelle Valley's attractiveness for beef-cattle raising obviously spurred a small number of husbandmen to engage in it. In relation to the importance of provincial cattle-rearing districts, the Qu'Appelle Valley stood at the midpoint.

Like beef-cattle raising, the swine industry was numerically more important in the Qu'Appelle Valley than in the Regina Plains, but could not match Battleford or Humboldt averages. Varying in numbers from 4.31 per farm in 1911 to 5.83 in 1916, swine could hardly be expected to make a dent in the Qu'Appelle Valley economy. Raised for household consumption, hogs could only supply pin money to the valley's farmers at best. Yet in comparison with figures from provincial districts, Qu'Appelle hog raising was about the average. For each year of the survey, except 1916, the valley's averages remained higher than those of the Regina Plains. On the other hand, Battleford and Humboldt averages in excess of 6 hogs per farm demonstrate that in these regions the industry had become commercially viable, a development that failed to occur in the Qu'Appelle (Table 4).

Table 3. Average Number of Beef Cattle per Farm in Selected Saskatchewan Regions, 1911-26

Year		Qu'Appelle Valley	Regina Plains	Assiniboia	Battleford	Humboldt
1911	Tot.	72,247	23,770	34,676	44,820	61.039
	Avg.	7.07	3.08	4.67	3.38	4.62
1916	Tot.	60,697	34,429	30,310	27,490	30,683
	Avg.	6.66	3.02	6.29	4.81	3.86
1921	Tot.	45,657	80,432	55,171	51,126	78,535
	Avg.	6.09	5.22	9.71	7.59	7.84
1926	Tot.	42,336	78,344	57,633	37,470	90,987
	Avg.	5.31	5.46	10.26	5.5	8.89

Qu'Appelle Valley - 1887, 3526 total, 1.86 avg.; 1891, 8640 total, 7.02 avg.

Table 4. Average Number of Swine per Farm in Selected Saskatchewan Regions, 1911-26

Year		Qu'Appelle Valley	Regina Plains	Assiniboia	Battleford	Humboldt
1911	Tot.	44,070	29,601	31,710	33,342	43,470
	Avg.	4.31	3.84	4.27	2.52	3.29
1916	Tot.	52,851	66,684	31,582	38,967	52,276
	Avg.	5.8	5.85	6.54	6.82	6.58
1921	Tot.	36,362	44,705	23,033	26,715	47,103
	Avg.	4.85	2.9	4.06	3.96	4.7
1926	Tot.	46,529	65,034	51,614	35,492	73,184
	Avg.	5.83	4.53	9.19	5.2	7.15

Qu'Appelle Valley - 1887, 6626 total, 3.5 avg.; 1891, 2386 total, 1.94 avg.

Qu'Appelle farmers engaged in horse raising as extensively as in other parts of the province. The fertility of valley soils for grain growing served as a sufficient inducement to raise horses to power prairie ploughs. From small beginnings horse raising quickly rose to economic importance. Before the turn of the century a significant number of high quality Clydesdale mares and stallions had been brought into the heart of the valley to Fort Qu'Appelle.[23] By 1906 husbandmen bred large numbers of draft animals. One Qu'Appelle dealership, Creamer and Johnston, sold 179 horses during that year. Acquiring stock from the nearby valley, the town of Qu'Appelle achieved recognition as the province's leading horse distribution centre.[24]

At the outset of World War I, Qu'Appelle Valley equine production stood as a cornerstone in the regional economy.[25]

Statistically, the valley led all other regions of the province in horse raising during 1911 to 1926. Since farmers required large numbers of draft horses to power field machinery in the wheat-growing districts of the province, the Qu'Appelle Valley, Regina Plains and Assiniboia became important equine producers. A reduced demand for the ever-present Clydesdale in parkland regions limited the size of horse-breeding operations in Battleford and Humboldt. Even in relation to horse-breeding operations on the Regina Plains and Assiniboia, Qu'Appelle Valley operations were large. Making allowance for the inclusion of the more heavily mixed-farming townships on the eastern edge of the census district, the Qu'Appelle Valley averages of 9.71 in 1911 and 12.19 five years later surpassed the figures registered in the Regina Plains and Assiniboia districts.[26] Unaltered Qu'Appelle Valley figures of 12 and 11.86 for 1921 and 1926 appear considerably higher than those for the other two dry-land regions. In relation to the Qu'Appelle Valley, Battleford and Assiniboia averages are very low. Declining to a minimum of 3.24 horses per farm, parkland horse-rearing could not expect to compete with the dry-land regions. In relation to the rest of the wheat province, the Qu'Appelle Valley boasted an extremely productive and profitable horse-raising industry.

Conclusion

The value of livestock rearing in relation to the monetary value of grain most truly reflects the importance of animal husbndry in a district (Table 5). In terms of this correlation, the Qu'Appelle Valley livestock industry ranks above that of the Regina Plains but well below the parkland areas. Eliminating the eastern mixed-farming

Table 5. Average Number of Horses per Farm in Selected Saskatchewan Regions, 1911-26

Year		Qu'Appelle Valley	Regina Plains	Assiniboia	Battleford	Humboldt
1911	Tot.	89,040	63,130	63,663	42,977	47,381
	Avg.	8.71	8.19	8.57	3.24	3.58
1916	Tot.	101,969	106,122	60,519	45,768	55,381
	Avg.	11.19	9.3	12.55	8.02	6.97
1921	Tot.	90,035	149,904	62,537	63,935	59,672
	Avg.	12	9.74	11.01	9.49	5.96
1926	Tot.	94,599	152,048	63,382	72,353	65,115
	Avg.	11.86	10.6	11.29	10.6	6.36

Qu'Appelle Valley - 1887, 3288 total, 1.74 avg.; 1891, 5170 total, 4.2 avg.

districts, the net returns from livestock in the Qu'Appelle Valley were about 18 per cent of the income from grain in 1911 and 23 per cent in 1916. These figures exceed corresponding data for the Regina Plains and Assiniboia. Statistics from the 1921 *Census of Canada* and the 1926 *Census of Saskatchewan* suggest that this relationship continued. Of course, data from Battleford and Humboldt imply that the animal husbandry endeavours in the valley could not match. Generally, Battleford and Humboldt averages fluctuated between 17 and 37 per cent.[27] Statistically, Qu'Appelle Valley animal industry reflected that of a dry-land region, but one where farmers could take advantage of certain geographical features to establish livestock rearing on a small scale (Table 6).

Table 6. Livestock Value in Relation to Grain for Selected Saskatchewan Regions, 1911-26

Year		Qu'Appelle Valley	Regina Plains	Assiniboia	Battleford	Humboldt
1911	Livestock $	3,386,546	1,728,567	1,759,291	2,740,967	3,452,831
	Grain $	15,968,133	11,527,312	8,967,756	4,327,999	6,970,785
	Stock %	2.12	15	19.62	63.33	49.53
1916	Livestock $	6,101,179	4,560,659	3,284,852	3,468,134	3,869,694
	Grain $	21,178,005	34,389,278	16,959,464	13,262,625	15,722,964
	Stock %	28.9	13.26	19.37	26.15	24.61
1921	Livestock $	3,425,296	5,804,413	3,360,091	3,172,723	4,366,944
	Grain $	27,008,272	30,862,746		16,127,923	11,695,010
	Stock %	12.68	18.9		19.67	37.34
1926	Livestock $	2,728,067	3,369,180	3,022,838	2,002,911	3,072,082
	Grain $	32,666,301	48,161,240	12,889,128	27,556,468	24,379,644
	Stock %	8.35	7	23.45	7.26	12.6

As in other parts of Saskatchewan, animal husbandry in the Qu'Appelle Valley played only a supportive role to grain growing. Farmers engaged in some dairying but the industry's importance proved marginal. Cattle and swine raising merely supplemented grain incomes. Only in horse raising did valley farmers register a success.

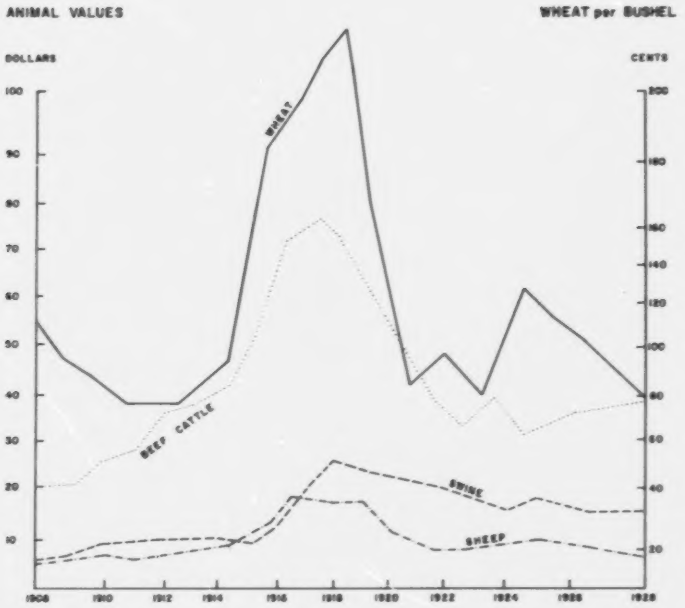

Figure 20. Individual values - wheat and livestock.

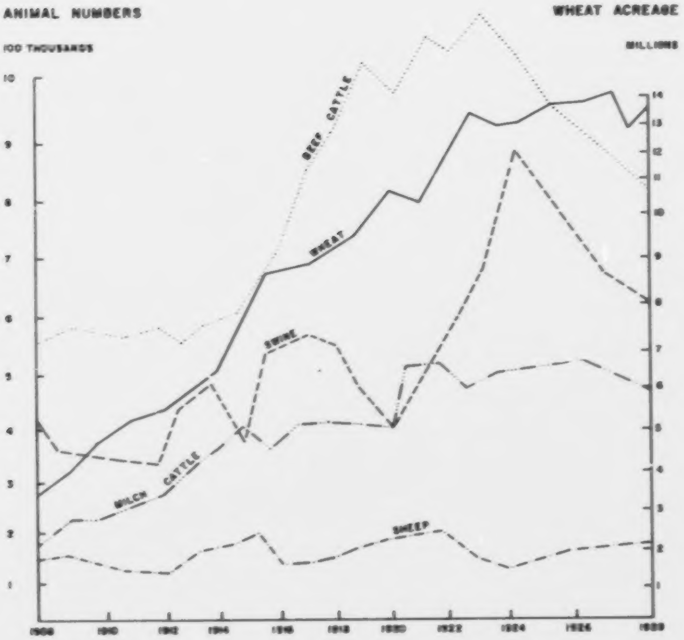

Figure 21. Production figures - wheat acreages and livestock numbers.

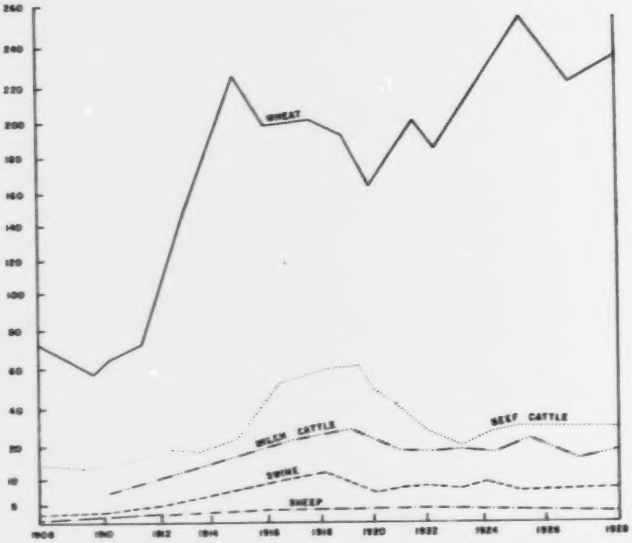

Figure 22. Total value - wheat and livestock. (Dairying statistics begin in 1917 except for a 1910 citation.)

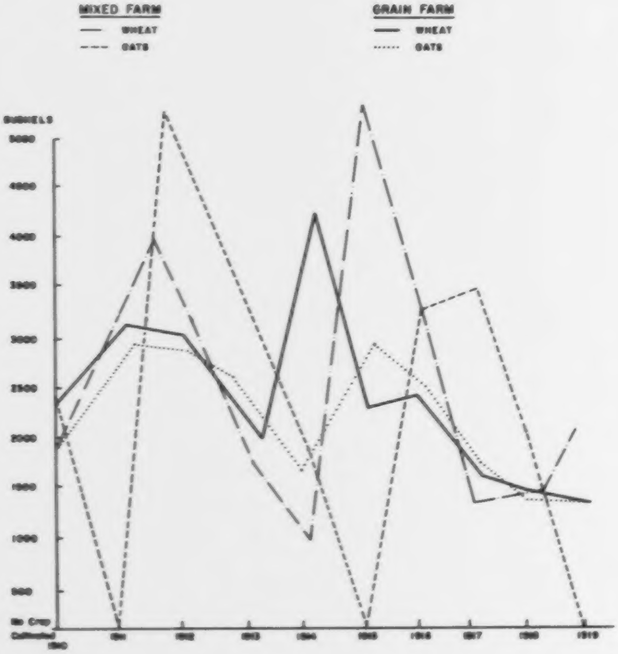

Figure 23. Annual yields on mixed farm and grain farm.

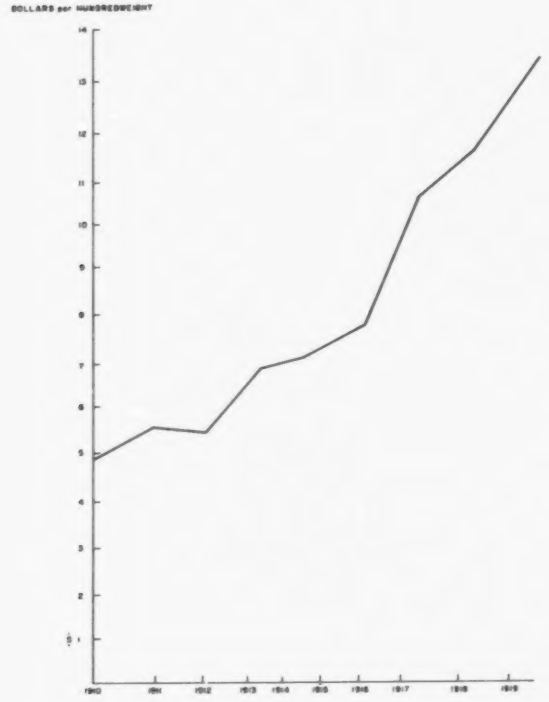

Figure 24. Returns from beef cattle.

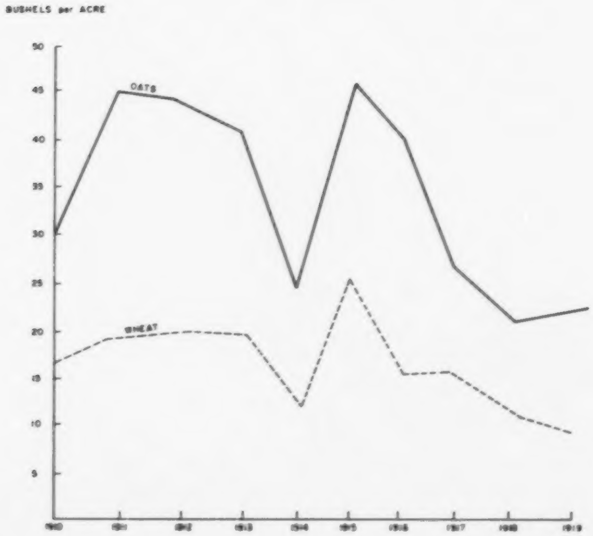

Figure 25. Yield per acre - wheat and oats.

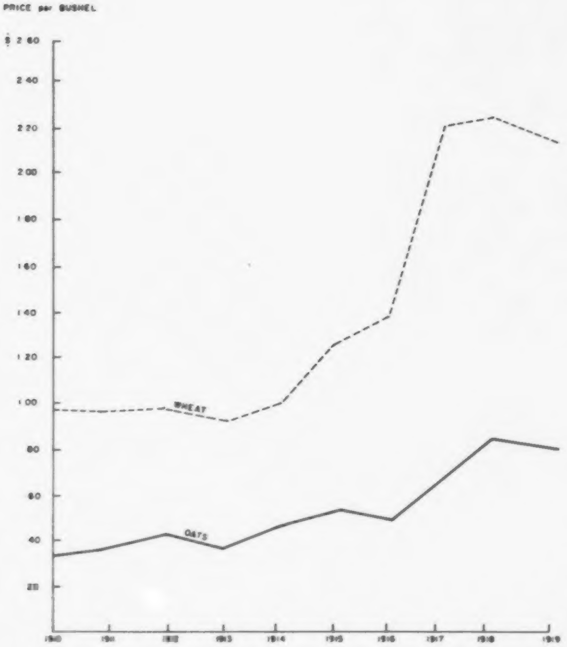

Figure 26. Returns from wheat and oats.

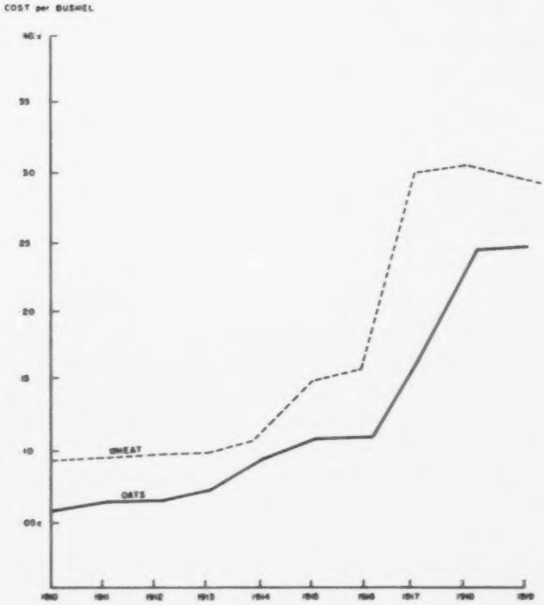

Figure 27. Cost per bushel for threshing.

CONCLUSION

Despite many advances in technology and methodology, animal husbandry remained second in importance to grain growing through the prairie dry belt by 1920. During 1880 to 1920 grain growing had proven more practical and profitable.

Promotional campaigns had attempted to popularize animal husbandry as a part of mixed farming, and as a result, individuals, agricultural journals and governments entered the field. John Gunion Rutherford, Dominion Livestock Commissioner, constantly polemicized the benefits of mixed farming. On dairying topics none possessed a greater knowledge than W.A. Wilson. William Richard Motherwell was a persistent advocate of farm diversification in Saskatchewan. Agricultural journals quickly rose to the mixed-farming cause. *The Nor'-West Farmer* (Winnipeg) expressed sympathetic views from 1883 onwards. *The Saskatchewan Farmer* (Moose Jaw) adopted a similar editorial policy. Provincial governments encouraged animal husbandry. Through its Agricultural Extension Branch, the Saskatchewan Department of Agriculture dispatched lectures on livestock topics to farmers' meetings held throughout the province. Other Saskatchewan endeavours included funding stock-judging competitions at rural fairs and assembling Better Livestock Trains to upgrade animal quality. Only the reluctance of the Dominion government to participate fully reduced the success of the campaign.

Experimental Farms at Brandon and Indian Head appeared reluctant to engage in animal-rearing tests. Moreover, the federal Department of Agriculture published few pamphlets on stock rearing for prairie climatic conditions - a policy that continued until midway through World War I. When the federal government decided to join its provincial counterparts, its programme appeared too late to be effective. Early federal government hesitation negated the efforts undertaken by individuals, the agricultural press and the provinces.

Advances in veterinary science made animal-raising practical. Commencing operations as early as the mid-19th century, educational institutions such as the Ontario Veterinary College made efforts to train future veterinarians. Following up late Victorian diagnoses of animal disorders, 20th-century researchers developed vaccines for anthrax, hog cholera and bovine tuberculosis as well as improved dips for sheep scab and cattle mange. Through its Livestock and Health of Animals branches the Dominion government refined existing programmes of livestock quarantine, disease detection and elimination. The efforts of the Ontario Veterinary College individual researchers and the Ottawa government had transformed most animal disorders from certain killers into readily curable maladies.

Husbandmen ushered in animal-rearing advances but left gaping holes in barn technology. Leading agricultural periodicals published numerous articles on winter livestock rationing. They also dealt with such topics as swine, cattle, and sheep breeding, horse training and milch-cow handling. One problem area remained unresolved - animal housing. On blistery or calm days, the newly developed King and Rutherford ventilation systems did not provide the supplies of fresh dry air for which they had been designed. The lack of adequate ventilation systems in prairie barns thereby resulted in continued livestock losses and animal-rearing advances had gone to naught.

A major reason for the lack of enthusiasm among husbandmen for farm diversification lay in the high cost of entering animal husbandry. Coupled to this was the limited opportunity of securing barns and silos to supplement their grain-growing tools. Moreover, livestock required forage - preferably succulent feeds such as bromegrass or alfalfa. Brome and alfalfa seed were priced beyond the reach of many farmers while great numbers of husbandmen did not possess the skills necessary for their successful maturation. Above all, forage crops diverted valuable wheatfields to a non-marketable commodity for periods up to five years in duration. Clearly the investment did not make the effort worthwhile.

Horse breeding became the only sizeable line of animal rearing in the wheat-growing area of the prairie dry belt. The reason for the success of the draft animal was obvious: farmers needed animals to pull grain-farming implements. After a lengthy 19th-century controversy between advocates of the draft horses and the general purpose animal, the draft horse became predominant on the Canadian Plains. Farmers selected more medium-weight Clydesdales than other varieties for their grain cultivation practices. By the end of World War I horse breeding stood as a keystone in the Saskatchewan economy.

ENDNOTES

Introduction

1 Saskatchewan. Department of Agriculture, Annual Reports, Sessional Papers, 1908. Comprehensive livestock statistics first appeared in these reports. This study utilizes statistics derived from this source for 1908 to 1928.

2 Saskatchewan. Department of Agriculture, Annual Report, 1926, p. 247.

3 Saskatchewan. Department of Agriculture. Annual Reports.

Encouraging Animal Husbandry

1 John G. Rutherford, "A Plan for Mixed Farming," Nor'-West Farmer, 6 Jan. 1913, p. 32.

2 John G. Rutherford, "The Livestock Industry in Western Canada," Nor'-West Farmer, 5 Nov. 1912, p. 1399.

3 "Dr. Rutherford on the Western Cattle Industry," Nor'-West Farmer, 20 March 1907.

4 John G. Rutherford, "The Livestock Industry in Western Canada," Nor'-West Farmer, 5 Nov. 1912.

5 W.R. Motherwell, "Why Agricultural Operations in Saskatchewan Should Be Diversified," Address to Agricultural Societies' Convention, Regina, 12 Dec. 1907. Saskatchewan. Department of Agriculture, Annual Report, 1907, pp. 178-79.

6 Ibid., pp. 180-81.

7 Saskatchewan Archives - Saskatoon (hereafter cited as SAS), W.R. Motherwell Papers, File 72 - No. 11,080-1, W.R. Motherwell, Saskatchewan Minister of Agriculture, Regina to John Bright, Livestock Commissioner, Department of Agriculture, Ottawa, 6 Jan. 1917.

8 SAS, Saskatchewan. Department of Agriculture, Dairy Branch Records, W.A. Wilson Letterbooks, W.A. Wilson, Regina to J.A. Ruddick, Chief of Dairy Division, Ottawa, 16 Aug. 1903.

9 SAS, Dairy Branch Records, Wilson to Ruddick, 3 Aug. 1903.

10 SAS, Dairy Branch Records, Wilson to Philip Sheffrer, Annaheim Saskatchewan, 11 March 1906.

11 Saskatchewan. Department of Agriculture, Annual Report, 1912, p. 101.

12 "Advantages of Mixed Farming," Nor'-West Farmer, Winnipeg, Manitoba, August 1889, p. 164.

13 S.A. Bedford, "Mixed Farming," Nor'-West Farmer, August 1893, pp. 197-98. Some of the arguments advanced in favour of animal husbandry were specious. S.A. Bedford found "a wheat field breasthigh waving in the wind.....a pleasant sight, but it lasts for a short time, while farm animals are a source of interest all the year round." William Noble mentioned the thrill farmers would

experience while watching their cattle ruminate on a cold winter night. (William Noble, "Mixed Farming," Nor'-West Farmer, 20 Aug. 1901.)

14 "Sheep - Their Position in Agriculture," Nor'-West Farmer, November 1884, p. 209.

15 Alexander Middleton, "The Sheep Industry," Nor'-West Farmer, April 1886, p. 434.

16 "Experiences with Sheep," Nor'-West Farmer, March 1884, p. 57.

17 "Sheep - Their Position in Agriculture," Nor'-West Farmer, November 1884, p. 209.

18 "Money in Pigs," Nor'-West Farmer, October 1892, p. 254.

19 Edwin J. Brookes, "Profit in Pork Raising," Nor'-West Farmer, May 1893, p. 115.

20 "Money in Pigs," Nor'-West Farmer, October 1892, p. 254.

21 James Reilly, "Northwest Dairying," Nor'-West Farmer, September 1890, p. 443.

22 "The Breeding and Herding of Cattle," Nor'-West Farmer, April 1886, p. 443.

23 "Will Mixed Farming Pay?" Nor'-West Farmer, 5 July 1912, p. 963.

24 "Wheat Growing a Crime," Grain Growers' Guide, Winnipeg, Manitoba, 6 May 1914, p. 5.

25 A.F. Mantle,"Mixed Farming," Grain Growers' Guide, 6 May 1914, p. 9.

26 "Will Good Mixed Farming Pay?" Nor'-West Farmer, 5 March, 1912.

27 Ibid.

28 W.F. Stevens, "Sheep Raising and Wheat Growing," Nor'-West Farmer, 5 September 1912, p. 15.

29 "Sheep Industry in Saskatchewan," Saskatchewan Farmer, Moose Jaw, Saskatchewan, April 1912, p. 15.

30 W.F. Stevens, "Sheep Raising and Wheat Growing," Nor'-West Farmer, 5 September 1912, p. 15.

31 "Profits of Dairy Farming," Saskatchewan Farmer, January 1913, p. 15.

32 "Beef Raising in the West," Grain Growers' Guide, 8 March 1911, p. 8.

33 "Cattle Feeding Profitable," Nor'-West Farmer, 5 May 1911.

34 Canada. Department of Agriculture. Dominion Experimental Farm Reports, Sessional Papers, Indian Head, 1894.

35 Ibid., Brandon, 1904, pp. 331-32.

36 Ibid., Brandon, 1893, p. 381; Indian Head, 1917, pp. 578-79.

37 Ibid., Brandon, 1915, pp. 434-35.

38 Canada. Department of Agriculture. Livestock Branch, Bulletin No. 13, J.B. Spencer, Beef Raising in Canada, 1910, p. 79.

39 Canada. Department of Agriculture. Experimental Farms Exhibition Circular No. 60, E.S. Archibald and G.B. Rothwell, The Feeding of Swine, 1916; No. 61, E.S. Archibald and G.B. Rothwell, The Feeding of Sheep, 1916.

40 Canada. Experimental Farms, Bulletin No. 35, J.H. Grisdale, The Stave Silo, 1907.

41 Canada. Department of Agriculture, Annual Report, Sessional Papers, 1905, pp. xxv-xxvi.

42 Ibid., 1913, p. 22.

43 Public Archives of Canada (hereafter cited as PAC), Department of Agriculture. *Records of the Minister, Deputy Minister and Secretary*, RG17, AI, Vol. 1136, File 21,244, Martin Burrell, Minister of Agriculture, Ottawa, to Dr. A.W. Bell, Secretary, Western Canada Livestock Union, Winnipeg, 10 June 1914.

44 Ibid., Martin Burrell, Ottawa, to W.T. McDonald, Secretary, B.C. Stock Breeders' Association, Victoria, B.C., 17 Dec. 1912.

45 Ibid., *Livestock Division Files*, RG17, BIII, Vol. 2512, C2-12 pt. 1, Western Canada Livestock Union, H.S. Arkell, Livestock Commissioner, Ottawa to E.L. Richardson, Secretary-Treasurer Western Canada Livestock Union, Calgary, Alberta, 18 Oct. 1924.

46 PAC, RG17, 65/134, Vol. 2934, 30 1-4, "Dominion Livestock Branch Sire Purchase Policy," 1920.

47 Ibid., 30 1-3, Part I, Livestock General Matters, Extract from R.A. Davidson letter, 14 March 1923. No recipient given.

48 Ibid., Volume 2942, 30 1-12, Demonstration Trains, C.W. MacRae, Acting Livestock Commissioner, Ottawa, to J.H. Grisdale, Deputy Minister of Agriculture, Ottawa, 31 March 1923.

49 Ibid., Demonstration Trains, C.W. MacRae to J.H. Grisdale, 11 April 1923.

50 Gordon C. Church, "The Origins, Nature, and Development of the Saskatchewan Co-operative Creameries Association," M.A. Thesis, University of Saskatchewan, Saskatoon, 1960, p. 8.

51 Ibid.

52 Creameries were located at Grenfell, Maple Creek, Moose Jaw, Moosomin, Prince Albert, Qu'Appelle, Regina, Saskatoon, Whitewood and Yorkton. SAS, Saskatchewan, Department of Agriculture, *Dairy Branch Records*, W.A. Wilson Letter Books, "Summary of the Business of 1901 at the Dominion Government Creameries in the N.W.T."

53 SAS, *Dairy Branch Records*, IIB, Minister of Agriculture, J.A. Ruddick, "Memorandum re Government Creameries in Saskatchewan," (1907?).

54 Montana. Agricultural Experiment Station, Bulletin No. 3, Luther Foster, *Pig Feeding*, 1894; No. 21, Robert S. Shaw, *Sheep Feeding*, 1899; No. 94, R.W. Clarke, *Clover and Silage as Feeds for Dairy Cows*, 1913.

55 Montana. Agricultural Experiment Station, Bulletin No. 37, R.S. Shaw, *Pork Production in Montana*, 1902; North Dakota Agricultural Experiment Station, Bulletin No. 83, W.B. Richards, *Pork Production under North Dakota Conditions*, 1908.

56 North Dakota. Agricultural Experiment Station, Bulletin No. 45, J.H. Sheppard, *Feeding Trials with Work Horses*, 1900.

57 Montana. Agricultural Experiment Station, Bulletin No. 3, Luther Foster, *Pig Feeding*, 1894, p. 35.

58 North Dakota. Agricultural Experiment Station, Bulletin No. 97, R.M. Dolve, *Barn Plans*, 1912.

59 Montana. Agricultural Experiment Station, Bulletin No. 94, R.W. Clarke, *Clover and Corn Silage as Feeds for Dairy Cows*, 1913.

60 W.R. Motherwell, "Why Agricultural Operations in Saskatchewan Should be Diversified," Saskatchewan. Department of Agriculture, *Annual Report*, Sessional Papers, 1907, pp. 178-81.

61 Duncan Anderson, "The Needs of the Horse Breeding Industry," Saskatchewan Department of Agriculture, *Annual Report*, 1907, p. 173.

62 Saskatchewan. Department of Agriculture, *Annual Report*, 1919, p. 300.

63 Saskatchewan Archives, Regina (hereafter cited as SAR), Saskatchewan. Department of Agriculture, *Deputy Minister's Office-Records*, Better Farming Conference, "The Place of Live Stock in Dry Farming," Swift Current, 1920.

64 SAR, *Agricultural Society Records*, I302, E.L. Richardson, Secretary, Western Canada Livestock Union, Calgary, to F.H. Auld, Regina, 4 Feb. 1918.

65 Saskatchewan. Department of Agriculture, *Annual Report*, 1907, pp. 159-60.

66 Ibid., 1908, pp. 113-14.

67 Ibid., 1909, pp. 113-14.

68 SAR, Department of Agriculture, *Agricultural Societies Records*, I34, A.F. Mantle, Deputy Minister of Agriculture, Regina, to W.J. Rutherford, Dean of Agriculture, Saskatoon, 9 May 1914.

69 Ibid., I34, A.F. Mantle, Regina, to J.C. Noble, Brandon, 9 May 1914.

70 Ibid., I34, Mantle to Rutherford, 9 May 1914.

71 Ibid., I34, K.G. MacKay, University of Saskatchewan, to F.H. Auld, Regina, 23 July 1917.

72 Ibid., I188, W.R. Motherwell, "Saskatchewan Live Stock Policy," 1917 (?).

73 Ibid., I34, Better Farming Train Programme, 1920.

74 Ibid., I35, Better Training Trains, Saskatchewan Better Livestock Train, 1923.

75 Ibid., I35, Programme for Saskatchewan Better Livestock Train, 1925.

76 In 1922, H.S. Arkell was Dominion Livestock Commissioner, J.H. Grisdale, Canada's Deputy Minister of Agriculture, and W.R. Motherwell, Minister of Agriculture.

77 SAR, Saskatchewan, Department of Agriculture, *Deputy Minister's Office-Records*, X, J.28 Conferences and Conventions "Livestock Conference, Saskatoon," 1922.

78 Saskatchewan. Department of Agriculture, *Annual Report*, 1923, pp. 65-66.

79 Ontario Agricultural College. *Annual Report*, 1881.

80 Ibid., 1904, pp. 73-101.

81 University of Saskatchewan Archives (hereafter cited as USA), *Correspondence*, Animal Husbandry Report, 1916-17.

82 Ibid., Dairy Department Report, 1924-25.

83 Ibid., Veterinary Science Report, 30 June 1922.

84 Ibid., Animal Husbandry Report, 1916-17.

85 Ibid., 1923-24.

86 Ibid., 1916-17.

87 Ibid., Dairy Department Report, 1918.

88 Ibid., Animal Husbandry Report, 1923.

89 Ibid., 1916-17.

90 Ibid., 1923.

91 Ibid., Dairying, 1918-22. Memo from Arthur Potts, Professor of Animal Husbandry to W.J. Rutherford, Dean of Agriculture, 4 Oct. 1922.
92 Ibid., Dairying, 1918-22, Dairy Report, 1924-25.

The Extent of Veterinary Science and Animal Husbandry Advances, 1880-1925

1 Charles A. Mitchell, "A Note on the Early History of Veterinary Science in Canada," Reprint, Canadian Journal of Comparative Medicine, 1928-40, pp. 3-6.
2 Ontario. Department of Agriculture, Report of the Ontario Veterinary College, Sessional Papers, 1908, p. 10.
3 Ontario. Department of Agriculture, Report of the Ontario Agricultural College, Sessional Papers, 1916, pp. 23-25.
4 F. Eugene Gattinger, A Century of Challenge - A History of the Ontario Veterinary College (Toronto, 1962), p. 83.
5 Fred Torrance, "Progress of Veterinary Science," Nor'-West Farmer, 5 July 1899, pp. 417-18.
6 Fred Torrance, "A Century of Progress in Veterinary Science," Nor'-West Farmer, 20 Dec. 1900, p. 977.
7 Fred Torrance was raised in Montreal and graduated from McGill University with a B.A. in 1878. After spending a year at the Ontario Agricultural College, he enrolled at the Montreal Veterinary College where he received his doctorate in 1882. He settled in Brandon immediately after completing his studies. Fred Torrance, "The Cow's Udder: Its Structure, Functions, and Diseases," Nor'-West Farmer, January 1897, p. 7.
8 Fred Torrance, "The Value of Symptoms," Nor'-West Farmer, November 1897, pp. 369-71.
9 "Blackleg," Nor'-West Farmer, August 1887, p. 915.
10 "Veterinary Association of Manitoba," Nor'-West Farmer, September 1890, pp. 591-93.
11 Fred Torrance, "The Cow's Udder: Its Structure, Functions, and Diseases," Nor'-West Farmer, January 1897, pp. 7-8.
12 The dipping process consisted of two steps. Sheep were first immersed in a tank containing three pounds of arsenic, pearl and sulphur, and soft soap. Subsequent treatment in a vat holding one pound mercurial ointment, one pound rosin, six pounds lard, and a half pint oil of turpentine completed the process. J.R. Manning, Illustrated Stock Doctor and Live Stock Encyclopedia (Guelph, 1882), p. 832.
13 Ibid., pp. 883-84.
14 PAC, RG17, AI, Volume 940, File 132630, J. Armstrong General Manager, Pasteur Vaccine Company, Chicago, to Duncan McEachran, Chief Inspector of Stock, Department of Agriculture, Montreal, Quebec, 18 Feb. 1901.
15 Saskatchewan. Department of Agriculture, Circular, J.C. Smith, Blackleg - Its Nature, Cause and Prevention, pp. 304.
16 "Abortion Among Cows," Nor'-West Farmer, 5 May 1904, p. 435.
17 "Milk Fever," Grain Growers' Guide, 18 Nov. 1918, p. 12.
18 Canada. Department of Agriculture. Livestock Branch, Bulletin No. 12, J.B. Spencer, Sheep Husbandry in Canada, 1908, pp. 107-08.

19 "Hog Cholera," Grain Growers' Guide, 8 June 1914, pp. 14, 19.

20 Paul De Kreuf, Hunger Fighters (New York, 1928), p. 96.

21 "Cure for Hog Cholera," Saskatchewan Farmer, June 1914, p. 8.

22 L.H. Newman, "The Canadian Department of Agriculture," Nor'-West Farmer, 5 July 1910.

23 P.M. Abel, "A Veterinary Accounting," Grain Growers' Guide, 7 Sept. 1921, p. 8.

24 Albert N.P. Morgan, ed., Canadian Men and Women of the Time (Ottawa, 1898), pp. 733-34.

25 PAC, RG17, AI 2. General Letterbooks - Minister, Deputy Minister and Senior Officials, Vol. 1550, John Lowe, Secretary, Department of Agriculture, Ottawa to D.H. McFadden, Veterinary Surgeon, Emerson, Manitoba, 18 Aug. 1885.

26 Ibid., Vol. 1552, John Lowe, Ottawa, to Duncan McEachran, Winnipeg, 27 Jan. 1886.

27 Ibid., Vol. 1564, John Lowe, Ottawa to Duncan McEachran, Ottawa, 7 April 1888.

28 PAC, RG17, AI, I, Vol. 2476, File 117,509, Report of the North West Mounted Police Commissioner, 9 Nov. 1898.

29 Ibid., Vol. 2752, File 130,197, Report of the North West Mounted Police Commissioner, 1900.

30 Ibid., Vol. 2753, File 134,847, Report of the North West Mounted Police Commissioner, 19 Nov. 1901.

31 Ibid., Vol. 2747, File 118,457, A.L. Jarvis, Secretary, Department of Agriculture, Ottawa, to W.E. Martin, Veterinary Surgeon, Winnipeg, Manitoba, 14 March 1899.

32 Ibid., Vol. 940, File 132,620, A.L. Jarvis, Acting Deputy Minister of Agriculture, Ottawa, to A.B. Perry, Commissioner, North West Mounted Police, Regina, 25 April 1901.

33 PAC, RG17, AI I, Vol. 2749, File 124,289, Annual Report of the North West Mounted Police, 1899.

34 Henry A. Morgan, ed., Canadian Men and Women of the Time (Ottawa, 1912), p. 985.

35 "Dr. F. Torrance Becomes Dominion Veterinarian," Nor'-West Farmer, 5 Aug. 1912, p. 1074.

36 Henry A. Morgan, ed., Canadian Men and Women of the Time (Ottawa, 1912), p. 988; "Dr. F. Torrance Becomes Dominion Veterinarian," Nor'-West Farmer, 5 Aug. 1912, p. 1074.

37 Canada. Report of the Veterinary Director-General and Livestock Commissioner, Sessional Papers, 1906, pp. 36-39.

38 Ibid., pp. 14-15.

39 Ibid., p. 51.

40 Canada. Department of Agriculture. Report of the Veterinary Director-General, 1917.

41 George Hilton, "Hog Cholera," Agricultural Gazette of Canada, Ottawa, Ontario, February 1917, pp. 120-22.

42 Canada. Department of Agriculture. Report of the Veterinary Director-General and Livestock Commissioner, 1906, p. 38.

43 Canada. Department of Agriculture. Report of the Veterinary Director-General, 1914, p. 55.

44 Canada. Department of Agriculture. Report of the Veterinary Director-General and Livestock Commissioner, 1906, p. 144.

45 Canada. Department of Agriculture. Report of the Veterinary Director-General, 1913, p. 63.

46 "Fundamental Principles in Dairy Feeding," Nor'-West Farmer, February 1896, pp. 38-39.

47 ibid.

48 S.A. Bedford, "How Can we Extend the Milking Period of our Dairy Herd?" Nor'-West Farmer, March 1897, pp. 75-76.

49 "The Fall Feeding of Cows," Nor'-West Farmer, October 1888, p. 261.

50 S.A. Bedford, "How Can we Extend the Milking Period of our Dairy Herd?" Nor'-West Farmer, March 1897, p. 75.

51 "Let the Tails Go Too," Nor'-West Farmer, May 1888, p. 117.

52 J.H. Monrad, "The Care of Mills," Nor'-West Farmer, August 1892, pp. 212-13. Suffice to say husbandmen also did not heed farm journal suggestions for tail removal.

53 "The Cow For Dairymen," Saskatchewan Farmer, January 1914, p. 23.

54 "Prof. Grisdale on Calf Raising," Nor'-West Farmer, 20 April 1908, p. 347.

55 W.J. Elliott, "The Importance of the Calf," Saskatchewan Farmer, September 1912, p. 19.

56 J.W. Mitchell, "More Profitable Dairying," Nor'-West Farmer, 20 March 1900, pp. 222-25.

57 Charles Michie, "The Beef Steer - How to Select and Feed Him," Nor'-West Farmer, December 1892, p. 43.

58 "Feeding Cattle," Nor'-West Farmer, May 1884, p. 98.

59 "Cattle Feeding," Nor'-West Farmer, February 1888, pp. 38-39.

60 "Cattle - The Season to Feed for Profit," Nor'-West Farmer, November 1888, p. 291.

61 Angus MacKay, "Stock Feeding for Profit in the Territories," Nor'-West Farmer, March 1895, pp. 44-45.

62 W.C. McKillican, "Winter Steer Feeding at Brandon," Nor'-West Farmer, 20 Jan. 1916, p. 59.

63 Canada. Department of Agriculture, Livestock Branch, Sheep and Goat Division, Pamphlet No. 2, T.R. Arkell, Preparing Wool for Market (Ottawa, 1914), p. 4.

64 R.C. Harvey, "Blending the Sheep Breeds," Nor'-West Farmer, 6 Dec. 1915.

65 Canada. Department of Agriculture, Bulletin 41 (new series), J.B. Spencer, Sheep Husbandry in Canada (Ottawa, 1924), pp.45-47.

66 J. McCaig, "Sheep Raising on Grain Farms," Nor'-West Farmer, 5 Feb. 1920, p. 207.

67 Canada. Department of Agriculture. Bulletin 41 (new series), J.B. Spencer, Sheep Husbandry in Canada (Ottawa, 1924), p. 46.

68 W.H.J. Tisdale, "Shearing and Dipping the Farm Flock," Nor'-West Farmer, 5 May 1917, p. 523.

69 Canada. Department of Agriculture. Livestock Branch, Pamphlet No. 2, T.R. Arkell, Preparing Wool for Market, 1914, p. 6.

70 "The Pig - How to Keep," Nor'-West Farmer, November 1884, p. 208.

71 Thomas Shaw, "The Sow in Gestation," Nor'-West Farmer, December 1895, p. 223.

72 James Elder, "The Care and Management of Breeding Swine," Nor'-West Farmer, March 1895, pp. 41-42.

73 "A Study in Breeds of Swine," Nor'-West Farmer, 6 July 1914, pp. 758, 760, 762, 763.

74 "The Value of Dairy By-Products in Pig Feeding," Nor'-West Farmer, 20 May 1905, p. 469.

75 W.C. McKillican, "Value of Pastures in Pork Production," Nor'-West Farmer, 4 March 1917, p. 249.

76 "Stables for the N.W.T.," Nor'-West Farmer, February 1895, p. 23.

77 R. McCaig, "The Housing of Sheep," Nor'-West Farmer, 20 Nov. 1905, p. 1032.

78 "A Model Hog House," Nor'-West Farmer, September, 1893, p. 227.

79 Canada. Department of Agriculture. Experimental Farms Service, Bulletin 51, J.H. Grisdale, Bacon Pigs in Canada (Ottawa, 1905), pp. 22-24.

80 J.G. Rutherford, "Stable Hygiene," Nor'-West Farmer, 20 Oct. 1900, pp. 803-805.

81 Ibid.

82 Canada. House of Commons. Evidence of Dr. J.G. Rutherford, Veterinary Director-General, Before the Select, Standing Committee on Agriculture and Colonization (Ottawa, 1906), pp. 110-16.

83 Canada. Department of Agriculture. Experimental Farms Service, Bulletin 35, J.H. Grisdale, The Stave Silo (Ottawa, 1907), pp. 7-11.

84 Saskatchewan. Department of Agriculture, Circular, A.R. Greig, Plans and Suggestions For a Practical Farm Barn (Regina, 1917), pp. 3-5.

85 "A General Purpose Barn," Grain Growers' Guide, 8 March 1916, p. 23.

86 O.H.Brown, "A Handy Barn for Mixed Farming," Nor'-West Farmer, 6 March 1911, pp. 294-95.

87 "Ventilating the Cow Barn," Grain Growers' Guide, 17 March 1915, p. 8.

88 Manitoba Agricultural College, Bulletin No. 13, L.J. Smith, Barn Ventilation (Winnipeg, 1914), pp. 6-10.

89 Ibid., p. 10.

90 Canada. Department of Agriculture, Bulletin 41 (new series), J.B. Spencer, Sheep Husbandry in Canada (Ottawa, 1924), pp. 86-92.

91 W.C. McKillican, "Housing Swine in Winter," Grain Growers' Guide, 5 Nov. 1914, pp. 34-35.

92 Manitoba Agricultural College. Bulletin 10, L.J. Smith, Plans for Farm Buildings (Winnipeg, 1913), pp. 32-33.

93 "Winter Housing for Swine," Saskatchewan Farmer, December 1918, p. 22.

94 Alberta. Department of Agriculture, Livestock Branch, Pamphlet No. 3, W.T. Stevens, The Housing of Swine (Edmonton, 1913), pp. 18-23.

95 Manitoba Agricultural College, Bulletin 17, T.J. Harrison, and J.H. Bridge, Silo Construction and Ensilage Production in Manitoba (Winnipeg, 1915), pp. 10-11.

96 "Silo Construction," Grain Growers' Guide, 15 March 1922, p. 18.

97 Manitoba Agricultural College, Bulletin 17, Harrison and Bridge, Silo Construction and Ensilage Production in Manitoba, pp. 11-13.

98 George Hutton, "The Trench Silo," Grain Growers' Guide, 15 March 1922, pp. 24, 30.

Non-Technological Limiting Factors in Prairie Animal Husbandry

1 Advertisement for McKenzie Seed Company, Brandon, Grain Growers' Guide, 23 Feb. 1910, p. 3; 11 Feb. 1920, p. 27.

2 Saskatchewan. Department of Agriculture, Annual Report, Sessional Papers, 1922, p. 290.

3 In its 1912 Annual Report the Saskatchewan Department of Agriculture stated that little high quality seed was available in the province. Saskatchewan. Department of Agriculture, Annual Report, 1912, p. 219.

4 Advertisements for seeds in Grain Growers' Guide, 2 March 1910, p. 25; 10 March 1915, p. 19; 3 March 1920, p. 19.

5 John Bracken, Crop Production in Western Canada (Winnipeg, 1920), pp. 258, 267.

6 Canada. Department of Agriculture, Bulletin No. 8, W.H. Fairfield, Alfalfa Growing in Alberta (Ottawa, 1912), p.13.

7 Saskatchewan. Department of Agriculture, Annual Report, 1906-22.

8 Advertisements of MacKenzie Seed Company, Grain Growers' Guide, 23 Feb. 1910, p. 3; 3 March 1920, p. 19.

9 John Bracken, Crop Production in Western Canada, pp. 248-49.

10 Ibid., pp. 272-78.

11 "A Homesteader's Barn," Grain Growers' Guide, 13 Dec. 1916, p. 14.

12 "A Mixed Farmer's Barn," Grain Growers' Guide, 5 Jan. 1916, p. 27.

13 "A General Purpose Barn," Grain Growers' Guide, 8 March 1916, p. 23.

14 PAC, RG17, Acc. 65/134, Box 531, John Fixter, Supervisor Division of Illustration Stations, Ottawa to E.S. Archibald, Director, Experimental Farms, Ottawa, 26 March, 1923.

15 Manitoba Agricultural College. Bulletin 17, F.J. Harrison and J.H. Bridge, Silo Construction and Ensilage Production in Manitoba (1915) pp. 18-19.

16 Saskatchewan. Department of Agriculture, Annual Report, 1923, p. 17.

17 Statistics are derived from a number of sources. The $6448 farm price is taken from Saskatchewan, Report of the Grain Markets Commission, Sessional Papers, 1914, p. 21. The steer purchase price of $4.96 per hundredweight is taken from Saskatchewan, Department of Agriculture, Annual Report, 1911, p. 61. Prices of the seed drill, gang plow, mower and binder as well as barns and silos are taken from various articles in the Grain Growers' Guide. Graphs demonstrating annual yields and prices of various types of produce use statistics tabulated from average columns of Saskatchewan, Department of Agriculture, Annual Report, 1904-22, unless otherwise indicated.

18 The latter constitutes an arbitrary figure assigned on an estimation of a cow's weight after two years' feeding.

19 Forty acres of alfalfa plus a supplementary oat crop are deemed sufficient to sustain up to 20 cattle and 4 horses. Four horses could survive on 16 acres of oats.

Horse Raising on the Prairies

1 Jasper Frick, "The Horse for the North-west," Nor'-West Farmer, September 1887, p. 944.

2 "A Big Boom in Horse Breeding," Nor'-West Farmer, May 1889, p. 114.

3 Saskatchewan. Department of Agriculture, Annual Report, Sessional Papers, 1907, p. 27.

4 Ibid., 1909, pp. 89-91.

5 Ibid., 1926, p. 223.

6 Ibid., 1922, pp. 64-66.

7 "The Horse We Want,"; "Dr. Rutherford in the Ring," Nor'-West Farmer, March 1889, pp. 63-64.

8 Ibid.

9 "Horse Breeding at Brandon," Nor'-West Farmer, March 1893, p. 62.

10 Alex Duncan, "The Draft Stallion," Nor'-West Farmer, 20 Feb. 1901.

11 W.J. Rutherford, "Is Clydesdale Breeding Rightly Directed?" Nor'-West Farmer, 20 Feb. 1917, p. 104.

12 Wayne Dinsmore, "Development of the Percheron in Canada," Nor'-West Farmer, 20 Feb. 1917, p. 185.

13 G. de W. Green, "The Shire Horse," Nor'-West Farmer, 8 Jan. 1919, p. 8.

14 J.R. Manning, Illustrated Stock Doctor, pp. 272-75.

15 Ibid., pp. 339-40.

16 Fred Torrance, "Ailments of the Foal," Nor'-West Farmer, 5 July 1900, p. 480.

17 J.R. Manning, Illustrated Stock Doctor, pp. 314-15.

18 Ibid., pp. 403-05.

19 Ibid., pp. 295-301.

20 Canada. Department of Agriculture, Livestock Bulletin 12, J.G. Rutherford, Mange in Horses and Cattle (Ottawa, 1911), pp. 5-6.

21 Dr. McClellan, "Equine Influenza," Saskatchewan Farmer, January 1919, p. 11.

22 Saskatchewan. Department of Agriculture, Circular, Horse Breeding in Saskatchewan (Regina, n.d.), p. 8.

23 Canada. Report of the Veterinary Director General and Live Stock Commissioner, C.D. McGilvray, "The Control and Eradiction of Glanders," Sessional Papers, 1912, pp. 114-22.

24 "Horse Breeding at Brandon," Nor'-West Farmer, March 1893, pp. 58-59.

25 Ibid., pp. 61-62.

26 "Perils of Colt-Rearing," Nor'-West Farmer, February 1898, p. 44; J.G. Rutherford, "The Care of Brood Mares," Nor'-West Farmer, February 1889, p. 134.

27 Saskatchewan, Department of Agriculture, Circular, Horse Breeding in Saskatchewan, p. 2.

28 Ibid., pp. 1-2.

29 Canada. Department of Agriculture, Livestock Bulletin, 14, J.G. Rutherford, Horse Breeding and the Rearing of Colts (Ottawa, 1911), pp. 7-8.

30 Ibid., p. 8.

31 Saskatchewan. Department of Agriculture, Circular, Horse Breeding in Saskatchewan, p. 3.

32 E.L. Potter, "Care of the Stallion in the Summer Season," Nor'-West Farmer, 20 May 1919, pp. 751-52.

33 J.G. Rutherford, "The Care of Young Foals," Nor'-West Farmer, May 1890, pp. 476-77.

34 J.G. Rutherford, "The Care of Weanlings," Nor'-West Farmer, October 1892, p. 624.

35 "The Education of the Horse," Nor'-West Farmer, November 1892, p. 285.

36 "How to Feed Horses," Nor'-West Farmer, September 1884, p. 174.

37 "How to Winter Colts," Nor'-West Farmer, March 1892, pp. 57-58.

38 Canada. Department of Agriculture, Livestock Branch, J.G. Rutherford, Horse Breeding and the Rearing of Colts, p. 11.

39 C.D. McGilvray, "Management of the Brood Mare and Foal," Nor'-West Farmer, 5 April 1917, pp. 385-86.

40 Canada. Department of Agriculture, Livestock Bulletin 14, J.G. Rutherford, Horse Breeding and Rearing of Colts, p. 14.

41 Saskatchewan. Department of Agriculture, Circular (Regina, n.d.), Feeding and Care of Work Horse, p. 2.

42 "Working Farm Horses in Warm Weather," Nor'-West Farmer, 5 June 1918, pp. 747-48.

43 "Feeding Work Horses," Grain Growers' Guide, 15 June 1921, pp. 17-18.

44 Saskatchewan. Department of Agriculture, Circular, Feeding and Care of Work Horses, p. 3.

45 PAC, RG17, AII, Vol. 2740, "Regulations Respecting the Importation and Exportation of Horses," 1896.

46 PAC, RG17, AII, Vol. 978, File 15,443, "Order of the Minister of Agriculture Relating to Mange," 1903.

47 Canada. Department of Agriculture, Annual Reports, Sessional Papers, 1916, pp. 27-28.

48 Canada. Department of Agriculture, Annual Reports, Sessional Papers, 1921, p. 30.

49 Saskatchewan. Department of Agriculture. Deputy Minister's Office-Records, Vol. 7, 1. Press Circular - Stallion Shows and Proposed Dates, 1911.

50 Saskatchewan. Department of Agriculture. Agricultural Society Records, I, 287 Spring Stallion Show Prospectus, Oxbow, 1911.

51 Saskatchewan. Department of Agriculture and Agricultural Extension, Annual Report, 1907-14.

52 SAR, Department of Agriculture, Agricultural Society Records, I34, Better Farming Train, 1920, 1922; I35, Better Farming Train, 1925, Pamphlets.

53 Saskatchewan. Department of Agriculture, Annual Report, 1919, p. 240.

54 Saskatchewan. Department of Agriculture, Annual Report, 1907, p. 27.

55 Saskatchewan. Department of Agriculture, Annual Report, 1912, p. 183.

Animal Husbandry in the Qu'Appelle Valley

1 "Description of Qu'Appelle and Neighbourhood," Qu'Appelle Progress, Qu'Appelle, N.W.T., 30 April 1886.

2 "South Qu'Apppelle," *Qu'Appelle Progress*, 23 Feb. 1873, p. 1.

3 "Qu'Appelle and its Surroundings," *Qu'Appelle Progress*, 28 April 1887, p. 4.

4 "South Qu'Appelle and its Resources," *Qu'Appelle Progress*, 8 April 1893, p. 1.

5 The 1906 *Census of the North West Provinces* had not been used for this study because it fails to provide animal husbandry statistics for individual constituencies.

6 W.R. Motherwell, "Pasturage - Its Relation to the Dairy Interests in the Indian Head and Similar Localities," *Qu'Appelle Vidette*, 26 March 1896, pp. 1, 8.

7 L.G. Bell, "A Plea for Winter Dairying," *Nor'-West Farmer*, February 1898, p. 58.

8 SAR, Saskatchewan. Department of Agriculture, *Agricultural Society Records*, II, Fort Qu'Appelle, 1912.

9 SAR, Saskatchewan. Department of Agriculture, *Agricultural Society Records*, I, 101 Whitewood, 1896.

10 SAS, Saskatchewan. Department of Agriculture, II, B) *Deputy Minister of Agriculture's Correspondence*, Memorandum, J.A. Ruddick, re Government Creameries in Saskatchewan, 1905.

11 Ibid.

12 SAS, Saskatchewan. Department of Agriculture, II, A) *Deputy Minister of Agriculture's Correspondence*, W.A. Wilson, Regina to A.F. Mantle, Regina, 21 Nov. 1911.

13 "Qu'Appelle District," *Qu'Appelle Progress*, 23 Dec. 1897, p. 1.

14 "Qu'Appelle District and its Advantages," *Qu'Appelle Progress*, 16 March 1899, p. 4.

15 Saskatchewan. Department of Agriculture, *Annual Report*, 1915, pp. 30-32.

16 This statement applies to all regions except Assiniboia. It is difficult to determine why Assiniboia, a dry-land region, registered such consistently high milch cow totals per farm.

17 Tabulated from *Census of Canada*, 1911 and 1912, *Census of the Prairie Provinces*, 1916, and *Census of Saskatchewan*, 1926.

18 "Making Ensilage and Feeding Beef," *Qu'Appelle Vidette*, 13 Oct. 1897, p. 7.

19 Edwin J. Brookes, "Profit in Pork Raising," *Nor'-West Farmer*, May 1893, p. 7.

20 SAR, Saskatchewan. Department of Agriculture, *Agricultural Societies Records*, II, Report of Agricultural Institute Meeting, Wolseley, 3 March 1902.

21 "Prize list, South Qu'Appelle Agricultural Society Exhibition," *Qu'Appelle Progress*, 1 Sept. 1889, p. 2.

22 SAR, Agricultural Society Record, *Director's Report*, II, Fort Qu'Appelle, 1912.

23 "Thoroughbred Stock for Fort Qu'Appelle," *Qu'Appelle Vidette*, 5 April 1899, p. 5.

24 "The Horse Trade - A Rapidly Developing Business," *Qu'Appelle Progress*, 17 May 1906, p. 4.

25 "Horses Wanted," *Qu'Appelle Progress*, 8 Oct. 1914, p. 4.

26 The 1916 figure for Assiniboia is slightly higher than that for the Qu'Appelle Valley and constitutes the only exception to the argument set forth.

27 Grain value is defined as the value of spring wheat and oats, while livestock includes milch, beef cattle and swine. To determine the livestock value in relation to grain, the former number is divided by the latter.

BIBLIOGRAPHY

Agricultural Gazette of Canada. 1914-24. Ottawa, Ontario.

Alberta. Department of Agriculture. Livestock Branch. Pamphlet No. 3, W.T. Stevens, "The Housing of Swine." Edmonton, 1913.

Bogue, Alan. "The Progress of the Cattle Industry in Ontario During the Eighteen Eighties," Agricultural History, Vol. 21, No. 4 (December 1947), pp. 163-68.

Bracken, John. 1920. Crop Production in Western Canada. Grain Growers' Guide, Ltd., Winnipeg.
---. 1921. Dry Farming in Western Canada. Grain Growers' Guide, Ltd., Winnipeg.

Byerly, F.C. "Changes in Animal Science," Agricultural History, Vol. 30, No. 1 (January 1956), pp. 259-74.

Calvert, William F. "The Technological Revolution in Agriculture 1910-1955," Agricultural History, Vol. 30, No. 1 (January 1956), pp. 18-27.

Canada. Department of Agriculture, Annual Reports, Sessional Papers, Selected issues, 1899-1930.

Canada. Department of Agriculture, Bulletins of Dairy and Storage Commissioners' Branch, 1911.

Canada. Department of Agriculture, Bulletins of Health of Animals Branch, 1902-11.

Canada. Department of Agriculture, Bulletins of Livestock Branch, 1902-11.

Canada. Department of Agriculture, Bulletins, Pamphlets, and Circulars of Dominion Experimental Farms, 1887-1925.

Canada. Department of Agriculture, Dominion Experimental Farm Reports, Sessional Papers, 1889-1925.

Canada. Department of Agriculture, Pamphlets of Sheep and Goat Division, 1914.

Canada. House of Commons. Evidence of Dr. J.G. Rutherford, Veterinary Director-General, Before the Select, Standing Committee on Agriculture and Colonization. Ottawa, 1906.

Clydesdale Horse Association of Canada. 1940. "Centennial Booklet."

Craig, John A. 1901. Judging Livestock. Des Moines.

Dean, Henry H. 1903. Canadian Dairying. Toronto.

De Kreuf, Paul. 1928. Hunger Fighters. New York.

Gattinger, F. Eugene. 1962. A Century of Challenge - A History of the Ontario Veterinary College. Toronto.

Gay, Carl, W. 1919. The Principles and Practice of Judging Live-Stock. New York.

Glenbow Foundation Archives, Calgary. Papers of Western Stock Growers' Association, 1896-1968.

Grain Growers' Guide. 1906-25. Winnipeg, Manitoba.

Guber, H.B. 1894. American Dairying - A Practical Treatice on Dairy Farming and the Management of Creameries. Chicago.

Hamer, R.S. 1925. "The Cattle Breeding Industry of Canada," G.F. Finlay, ed., Cattle Breeding - Proceedings of the Scottish Cattle Breeding Conference. London.

Hopkins, A.G. 1901. Veterinary Elements. Winnipeg.

Indian Head Vidette. 1905-8. Indian Head, Saskatchewan.

Jenkins, J. Geraint. 1965. "Technological Improvement and Social Change in South Cardigamshire," Agricultural History Review, Vol. 13, pp. 94-105.

Johnson, Keach. "Iowa Dairying at the Turn of the Century: The New Agriculture and Progressivism," Agricultural History, Vol. 45, No. 2 (April 1971), pp. 95-110.

Kelly, Kenneth. "The Transfer of British Ideas on Improved Farming in Ontario During the First Half of the Nineteenth Century," Ontario History, Vol. 63, No. 2 (June 1971), pp. 103-11.

Lawr, D.A. "The Development of Ontario Farming, 1870-1914: Patterns of Growth and Change," Ontario History, Vol. 64, No. 4 (December 1972), pp. 238-51.

Mackenzie, Ann. "Animal Husbandry in the 1840s as Reflected in the Agricultural Journals of Canada West," Ontario History, Vol. 66, No. 4 (December 1972), pp. 238-51.

Manitoba Agricultural College. Bulletins and Circulars, 1910-15.

Manning, J.R. 1882. Illustrated Stock Doctor and Live Stock Encyclopedia. Guelph. p. 832.

Marshall, Duncan. 1903. Feeding Farm Animals, n.p.

Mitchell, Charles A. 1928-40. "A Note on the Early History of Veterinary Science in Canada," Reprint, Canadian Journal of Comparative Medicine, pp. 3-6.

McCormick, Veronica. 1968. A Hundred Years in the Dairy Industry. Ottawa.

Montana. Agricultural Experiment Station, Bulletins, 1894-1920.

Montana State University Archives, Bozeman, Montana. Agricultural Economics Department, Montana Agricultural College Files, 1914-30. Correspondence of the Director of the Experiment Station, 1895-1948. Extension Services Reports, Montana Agricultural College, 1915-30.

Morgan, Albert N.P., ed. 1898. Canadian Men and Women of the Time. Ottawa. pp. 733-34.

Morgan, Henry A., ed. 1912. Canadian Men and Women of the Time. Ottawa. p. 985.

North Dakota. Agricultural Experiment Station, Bulletins, 1895-1915.

Nor'-West Farmer. 1883-1920. Winnipeg, Manitoba.

Ontario Agricultural College. Annual Report, 1881.

Ontario. Department of Agriculture, Veterinary College Reports, Sessional Papers, 1908-25.

Plumb, Charles S. 1928. Judging Farm Animals. New York.

Public Archives of Canada, Ottawa
Canada. Department of Agriculture, General Files, RG17, Accession 65/134.
Canada. Department of Agriculture. General Letterbooks - Minister, Deputy Minister and Senior Officials, 1881-1893, RG17, A I 2.
Canada. Department of Agriculture. Livestock Division Files, RG17, BIII.
Canada. Department of Agriculture. Records of the Minister, Deputy Minister and Secretary, RG17, AI, Series I and II.

Qu'Appelle Progress. 1885-99, 1900-15. Qu'Appelle, Saskatchewan.

Qu'Appelle Vidette. 1896-1912. Qu'Appelle, Saskatchewan.

Reaman, George E. 1946. History of the Holstein - Friesan Breed in Canada. Toronto.

Ross, Earle D. "Retardation in Farm Technology Before the Power Age," Agricultural History, Vol. 30, No. 1 (January 1956), pp. 11-18.

Saskatchewan Archives, Regina
Saskatchewan. Department of Agriculture. Agricultural Society Records.
Saskatchewan. Department of Agriculture. Deputy Minister's Office-Records.

Saskatchewan Archives, Saskatoon
Saskatchewan. Department of Agriculture. Dairy Branch Records.
W.R. Motherwell Papers.

Saskatchewan. Department of Agriculture. Annual Reports, Sessional Papers, 1905-25.

---. Bulletins and Circulars, 1910-23.

Saskatchewan Farmer. 1910-20. Moose Jaw, Saskatchewan.

Tyler, Cyril. "The Development of Feeding Standards for Livestock," Agricultural History Review, Vol. 4, Pt. 2 (1956), pp. 97-107.

United States Department of Agriculture. 1916. Disease of the Horse. Washington.
---. 1923. Diseases of Cattle. Washington.

University of Saskatchewan Archives, Saskatoon
College of Agriculture Records, University of Saskatchewan, 1910-1925.
Dean's Papers - Correspondence of William J. Rutherford.

University of Toronto Archives, Toronto
Files on Graduate Students - John Gunion Rutherford.

Whitewood Herald. 1900-12. Whitewood. Saskatchewan.

Winters, Lawrence M. 1925. Animal Breeding. New York.

FIELD AGRICULTURE ON THE CANADIAN PRAIRIES, 1870-1940

David Spector

108 Abstract
109 Preface
110 Introduction
113 Introduction of Dry-Farming Techniques on the Prairies: Wheat Cultivation
133 Supplementing Wheat with Other Crops
143 Mechanization
    143 Introduction of the Steam Plough and Threshing Machine
    146 Maintenance of the New Farm Machines
    152 Introduction of the Gasoline Tractor
157 Effect of Agricultural Societies and Agricultural Colleges on Field-Crop Production
    157 Agricultural Societies in the North-West Territories
    159 Agricultural Colleges on the Prairies
    172 Conclusions
173 Effects of Dominion Experimental Farms on Farm Improvement
    173 Creation of Dry-Belt Experimental Stations
    175 Contributions of Angus MacKay and Charles and William Saunders
    177 Experimental Tests at Brandon, Indian Head and Lethbridge
    181 Role of the Central Experimental Farm in Ottawa
185 W.R. Motherwell's Contribution to Dry Farming
    185 Motherwell's Early Training at the Ontario Agricultural College
    186 Motherwell's Advice to Grain Growers
    190 Motherwell's Administrative Achievements
191 Conclusion
193 Appendix A. The S. Richards' Diaries
196 Endnotes
210 Bibliography

ABSTRACT

Between 1880 and 1920 advances in dry-land farming techniques permitted the establishment of an agriculture-based economy on the Canadian Prairies. The development of scientific agriculture in western Canada in the late 19th century was a co-operative effort in whch all levels of government, agricultural societies, and individuals participated. It took the form of individual and institutional experimentation, formal educational programs and the public exchange of ideas. Not all the new techniques were adopted immediately as many farmers clung to familiar methods for some time. Yet by 1920 there was evidence of a general acceptance of new techniques of dry farming that effectively revolutionized prairie agriculture.

Submitted for publication 1977, by David Spector, Parks Canada, Prairie Region, Winnipeg.

PREFACE

This study is based on a wide assortment of collections from many Canadian archival institutions and libraries. Of prime importance is the fine collection of farm periodicals and specialized journals held in the Manitoba Provincial Library. Helpful unpublished collections include the Saskatchewan Department of Agriculture, Agricultural Society Papers at the Saskatchewan Archives, Regina, and Canada Department of Agriculture Records housed at the Public Archives of Canada. Materials less voluminous, but nevertheless useful, were located at the Glenbow-Alberta Foundation Archives in Calgary, Saskatchewan Archives, Saskatoon, and the University of Guelph Library. Whether providing extensive documentation or passing references, all sources proved invaluable in completing this final draft.

The librarians and archivists who assisted me are too numerous to mention. The staff of the Manitoba Provincial Library provided excellent service in locating and retrieving a maze of journals. Mr. Terry Cook, Natural Resources Archivist at the Public Archives of Canada, proved outstanding in pinpointing useful files in the Canada Department of Agriculture Records. The combined efforts of all archival and library staffs helped make this study possible.

INTRODUCTION

The years 1880-1920 were a period in which new techniques were used to make the semi-arid Canadian Plains productive. In the forefront of experimentation were the Ontario-bred agriculturalists. Not only did they experiment with these new techniques but they followed up their experiments with such care that by the beginning of the 1920s a comprehensive body of knowledge of dry-land farming was in existence. Popular and comprehensible texts such as John Bracken's *Dry Farming in Western Canada* and *Crop Production in Western Canada*, and Seager Wheeler's *Seager Wheeler's Book on Profitable Grain Growing* were readily available.

Although a number of works on the history of prairie agriculture have been written, the only major published work in Canadian prairie agriculture is Grant MacEwan's popular history *Between the Red and The Rockies*. Meanwhile Ernest Ingles' thesis on "Some Aspects of Dry-Land Agriculture in the Canadian Prairies to 1925" is also useful. The only comprehensive American treatment is Mary Hargreaves' *Dry Farming in the Northern Great Plains, 1900-1925*. All three studies have weaknesses in their interpretations, yet all three merit close examination.

Ingles' "Some Aspects of Dry-Land Agriculture in the Canadian Prairies to 1925" offers the following interpretation of the history of prairie agricultural techniques from the 1880s to the 1920s:

> Over twenty years ago Grant MacEwan depicted changes in agriculture in the prairies before the 1930s as an "agricultural revolution." What happened was less a revolution than a "delayed, halting [and] hesitant process," to borrow a phrase from Earle D. Ross' analysis of mechanization in American agriculture. While experimentation in animal and mechanical power and in tillage and cropping practices led to improved methods of dry-land agriculture during this period, many farmers were slow to abandon their traditional ways in favour of new techniques.[1]

Of course, the farming changes that occurred between 1880 and 1925 were neither total nor universal, and there were farmers who refused to utilize the new techniques. However, the evidence of the general acceptance of a suitable set of techniques for dry-land farming is overwhelming. Ingles errs when he states that farmers refused to abandon their traditional ways - in the development of dry-land techniques there were no traditions. The dry belt was a new farming area and farmers were eager to adopt new methods to make it productive. As early as the mid 1880s, the agricultural press in general, and the *Nor'-West Farmer* in particular, spearheaded the search for these methods. If letters to the editor are any indication, farmers encouraged this search and were eagerly seeking new techniques that would increase their incomes. Ingles fails to give credence to this enthusiasm for innovation and virtually ignores the fact that by 1920 western farmers had a series of monographs on proper cultivation techniques available. Had Ingles analysed the field crop manuals of Wheeler and Bracken, his assessment might have been different.

This is not to say that Ingles' work is not useful. While he tends to down-play the agricultural advances of the period and omits the writings of Bracken and Wheeler, he does delve into the practice of summer fallowing, methods of ploughing and sub-soiling techniques, mechanization of prairie farms, and custom threshing, and his bibliography is an excellent reference source.

As the only published overview of Canadian prairie agriculture, Grant MacEwan's *Between the Red and the Rockies*[2] has acquired an inordinate importance. It is MacEwan who described the agricultural developments between 1880-1920 as an "agricultural revolution." However, this term is somewhat confusing. It denotes too drastic a change from one type of farming to another. On the whole, farmers merely learned to cultivate different crops and new strains that would be productive in the new prairie environment. Despite this error in emphasis, MacEwan's book is a useful, general account of prairie agriculture. It deals both with cattle production and field crops and covers such diverse areas as the Hudson's Bay Company and agriculture, the Selkirk settlers, agricultural colleges and agricultural fairs.

American interpretations of the dry-farming era are few and not wholly relevant to the Canadian experience. The only major work of note is Mary Hargreaves' *Dry Farming in the Northern Great Plains, 1900-1925*.[3] Hargreaves sees the dry-farming movement as the creation of an American agriculturalist - Hardy Campbell. She then concludes that the discovery of new techniques was actually less an advance in agricultural technology than part of the publicity campaign waged by American railroads and land companies in their frenetic attempt to rid themselves of unsold acreages. In fact, Hargreaves claims that it was the addition of the element of publicity that formed the only major innovation in the dry-land movement in the 20th century. The dry-farming movement, as distinguished from general irrigationless cultivation in the semi-arid Prairies, had become primarily a promotional campaign. Although the proponents of dry-farming programmes emphasized their educational and experimental nature, the commercial support behind the propagandists was an overriding factor. Even the leadership provided by the Montana Agricultural Experimental Station was tainted by the venality of the transcontinental railway companies who supported the station's experimental programmes. No one was surprised when the railways and the real estate promoters embarked on their publicity campaigns well in advance of the Station's statement of final conclusions. Eventually, as the campaign became more organized, public as well as private agencies collaborated in subordinating instructional considerations to the desirability of attracting settlers. Agricultural scientists, then, could hope to offer leadership only under circumstances already limited by accomplished facts.[4]

The Hargreaves interpretation, however, can hardly be applied to the Canadian Prairies. The work of the Dominion Experimental Farms and the colleges of agriculture, first in Ontario and later throughout the country, made advances in field-crop technology more real than illusory. Hargreaves, therefore, is inapplicable to the Canadian situation. The period between 1880 and 1920 was an era of steady progress toward a comprehensive body of useful knowledge on the techniques and the technology of dry-land farming; it was neither an era of agricultural revolution nor one of slow halting change. It was the era in which the Prairies were made to be productive, and the leaders of the movement to conquer the new agricultural frontier were Ontarian settlers, many of whom had attended the Ontario College of Agriculture at Guelph.

The origins of dry farming centred around the development of summer fallowing and the treatment of grain for smut prevention after 1880. The decade after 1900 witnessed advances in land breaking, seed selection, tillage improvements, weed control and advanced smut control, as well as the popularization of the steam-powered tractor. The following decade saw the refinement of dry-farming techniques: ploughing and cultivation methods designed to preserve moisture, seed selection improvements, the popularization of Marquis wheat which had been developed to grow well under dry conditions, and the popularization of the lightweight gasoline tractor and threshing machine. By 1920 dry-farming techniques had become widely accepted as the gospel for prairie agriculture.

The culmination of dry-farming expertise came in 1919-21 with the publication of two studies by John Bracken and one by Seager Wheeler. Bracken's main work, *Dry Farming in Western Canada*, dealt with such topics as dry-farm crops and cropping practices, the principles of tillage, summer fallowing, crop rotation and weed control.[5] His second book, *Crop Production in Western Canada*, dwelt on the dry-land cultivation of wheat, oats, barley, rye, flax, alfalfa and potatoes.[6] Seager Wheeler's study probably represented the height of dry-farming methodology at the time. Published in 1919, *Seager Wheeler's Book on Profitable Grain Growing*, was written in a manner easily comprehensible by the average dry-land farmer.[7] Wheeler's main concern was the preservation of soil moisture. In meticulous detail he explained moisture preservation in breaking, seeding, harrowing, discing, soil packing and summer fallowing. By winning innumerable awards for his wheat, Wheeler also won a measure of personal fame and vast amounts of publicity for his methods.

In this study I present a detailed history of these developments in field agriculture on the Prairies during the years 1880-1920 discussing 1) wheat as the prairie mainstay and the application of dry-farming techniques to the cultivation of this crop; 2) the cultivation of other crops such as oats, barley, alfalfa, flax, bromegrass, and clover and the problems involved in their production; 3) the process of mechanization of prairie farms; 4) the impact of agricultural society and agricultural college educational programmes on advances in crop cultivation; 5) the effect of experiments conducted at Dominion Experimental Farms on the varieties of crops grown and the methods used in growing them; and finally, 6) an overall picture of the period 1880-1920 in field-crop husbandry placing W.R. Motherwell and his farmstead in the context of the study.

INTRODUCTION OF DRY-FARMING TECHNIQUES ON THE PRAIRIES: WHEAT CULTIVATION

From the first settlement on the Prairies wheat was the predominant field crop (Fig. 1). After 1900 acreages sown to wheat increased dramatically until 1919 when wheat represented about 63 per cent of all major crops.[1]

Wheat was able to establish a pre-eminence among prairie crops because techniques were devised to cultivate it successfully under semi-arid conditions. The advances in wheat-growing techniques - moisture preservation tillage procedures, proper seeding, weed control, and smut prevention measures - constituted the main achievements of dry-farming methodology. The evolution of these practices can be divided into four distinct phases: the early origins of wheat cultivation during the 1850s, the beginning of dry-farming, 1880-1900; the development of new techniques, 1901-10; and the refinement of these techniques, 1911-20.

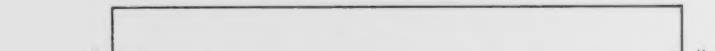

Figure 1. Crop acreages in the North-West Territories and Saskatchewan.

Wheat-cultivation techniques practised before 1880 were of little relevance to dry-belt conditions. This is particularly true of wheat growing at Red River between 1813 and 1880. From 1820 to 1848 an American wheat from the upper Mississippi Valley, Prairie du Chien, became the main cereal crop.[2] This was followed by the cultivation of Black Sea and Galician varieties. But an inherent weakness of Red River agriculture arose from limited production and the use of primitive implements. In 1831, with a total population in the Selkirk settlements of 2390, only 2152 acres were tilled, a fraction of this devoted to wheat.[3] By 1856 the per capita ratio had improved only fractionally as 8806 acres were planted for a population of 6691.[4] Crops were sown by broadcast method, harvested with scythes, and threshed with hand flails or the trampling of farm animals.[5] These methods were carried northwest by the Métis immigrations of the 1870s, but would prove inadequate for the vast acreages and highly mechanized techniques necessary to make dry-belt agriculture profitable.

At the same time, current Ontario-based wheat-growing methods were also inadequate for dry-belt agriculture. One heavy-handed type of field husbandry called "skinning or mining" involved sowing wheat on the same field year after year until the soil was exhausted. The field would then be permitted to lie fallow for several years before replanting.[6] Under certain conditions in the prairie dry belt, this type of agriculture would have resulted in a total crop failure in the second year. Another method of wheat growing in Ontario involved the rotating of winter and spring wheat with oats, barley or peas.[7] The main weaknesses in applying this method to the Prairies lay in the use of a broadcast seeder that would place the farmer's valuable seed at the mercy of the unrelenting prairie winds. Sowing winter crops might have mitigated these problems, but the severity of the prairie winter prohibited the cultivation of winter wheat except in Southern Alberta. Above all, eastern methods which only allowed the harvesting of ten acres per day would have ruined the dry-belt farmers. In short, a completely new set of farming techniques were required for dry-land agriculture.

The period from 1880 to 1900 saw the discovery and implementation of the basic techniques of successful dry-belt wheat cultivation. The genetic principles of seed selection were discovered, and a variety of wheat suitable to dry prairie lands was developed; the seed drill press was introduced, bluestoning wheat seed against smut commenced, and summer fallowing came to be used for its moisture preservation characteristics.

The most important discussion in the 1880s in prairie agricultural circles was the unresolved debate over the use of hard or soft wheats. The controversy reached a peak in 1885 with farmers voicing support for the cultivation of soft White Fyfe wheat while the agricultural journals tended to advocate the use of hard Red Fyfe. Some dry-belt farmers were particularly critical in their assessment of hard wheat. A.W. McClure, a farmer from Regina, wrote the following to *The Nor'-West Farmer*:

> I beg to respond to your invitation in the May number, asking those who have this season sown white fyfe and other kinds of spring wheat in preference to the red fyfe to give

> their reasons for doing so. In the first place I find the red fyfe germinates very slowly and requires to be sown very early, in fact before the frost is fully out of the ground, hence the harrowing can only be very imperfectly done, merely scratching the soil on the surface, and just as soon as the frost fully comes out the ground dries up very rapidly owing to the surface only being worked and the soil below when the young plant searches for nourishment is found to be in a very imperfect condition to withstand the drouth; in a dripping season it would probably be all right. I commenced seeding this spring on April 10th with red fyfe, and on April 20th sowed white fyfe, and at present writing the latter is much the farthest advanced, showing that white fyfe germinates quicker and will do to sow later when the soil can be better worked which gives it the advantage later on in the season. It shoots out readily, grows vigorously throughout the whole season, and ripens up fully before autumn frosts set in which so often catches the No. 1 hard.[8]

The Nor'-West Farmer, however, did not agree with McClure's assessment. It claimed that the sample of Red Fyfe wheat grown that year could compare with anything produced in the entire world. It was better to grow hard wheat than soft because soft wheats were grown everywhere, were only of the lowest commercial value and "only saleable when hard wheat is obtainable to work the flour product up to grade."[9] In the face of these advantages, the earlier ripening period of White Fyfe was not important; rather, *The Nor'-West Farmer* suggested, a system of farming permitting early seeding and earlier harvesting should be devised.[10] This controversy was not to be settled until the 1890s.

The controversy over hard and soft wheats was not resolved until the 1890s when Red Fyfe became the dominant variety grown on the Prairies. It achieved its hegemony after extensive testing in competition with White Fyfe and Ladoga. In the view of S.A. Bedford, Superintendent of the Brandon Experimental Farm, White Fyfe was a desirable wheat. It was not too prone to rust or smut and was less susceptible to frost damage than Red Fyfe.[11] Its disadvantage was that as a soft wheat it yielded about one bushel less per acre than the more marketable Red Fyfe. More of a challenge to the supremacy of Red Fyfe was Ladoga, a North Russian variety of hard wheat. First brought into the Prairies in 1887, Ladoga was used in extensive experiments by farmers and government alike. After its first baking test in November 1888 it was found to be drier than flour from Red Fyfe and slightly yellower.[12] The agricultural press, however, gave it the cold shoulder. *The Nor'-West Farmer* declared that Ladoga was inferior to Red Fyfe, except when grown under optimum conditions:

> While indisputably earlier by an average of about 10 days average of about 10 days than Red Fyfe, this gain was only made on choice new soils and under favouring conditions. On late dull lands, the main places where earliness is needed, the gain in time over Red Fyfe has

> been slight and more than offset by the great inferiority in quality of the yield. Sometimes the amount of the yield has not been much behind the Fyfe, though oftener some bushels behind. The shortage of yield would not have been of much account if early and good results had come along with it. But on unfavourable soils, both rust and smut were more manifest also, and this, when taken with the very unsatisfactory results from the majority of baking trials, as well as its saffron tint, was enough in the mind of THE FARMER to disqualify the Ladoga from ever taking a place as a merchantable wheat.[13]

Dominion test reports on the quality of Ladoga were the basis for *The Nor'-West Farmer*'s attitude. Apparently the final baking results in 1892 provided a bread so yellow in colour that the flour was unmarketable "even at a considerable reduction in price from the price of flours similarly made from No. 2 hard Manitoba."[14] Red Fyfe became pre-eminent because it produced the best and most marketable flour when compared with other varieties. As S.A. Bedford stated:

> It is seldom equalled, it has the brightest and stiffest of straw, and rust was scarcely noticeable with it this year, and smut does not spread so badly with it as it does with some other varieties, and of course the quality is ahead of anything we have yet found.[15]

Consequently, despite Red Fyfe's shortcomings - late ripening and the tendency to become severely damaged by frost - it became the standard wheat grown on the Prairies in general, and in the dry belt in particular, by the mid 1890s.

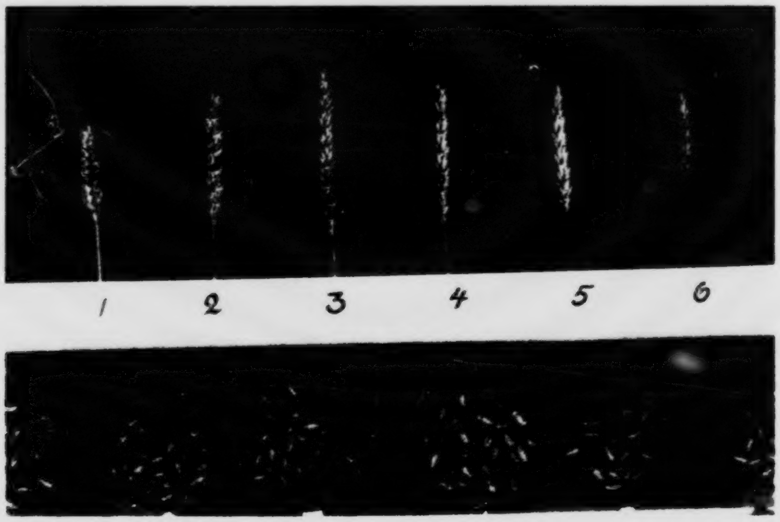

Figure 2. Wheat: 1. Kubanka Durum; 2. Marquis Hard Spring; 3. Red Fyfe Hard Spring; 4. Kitchener Hard Spring; 5. Preston Hard Spring; 6. Turkey Hard Winter. (Saskatchewan Archives.)

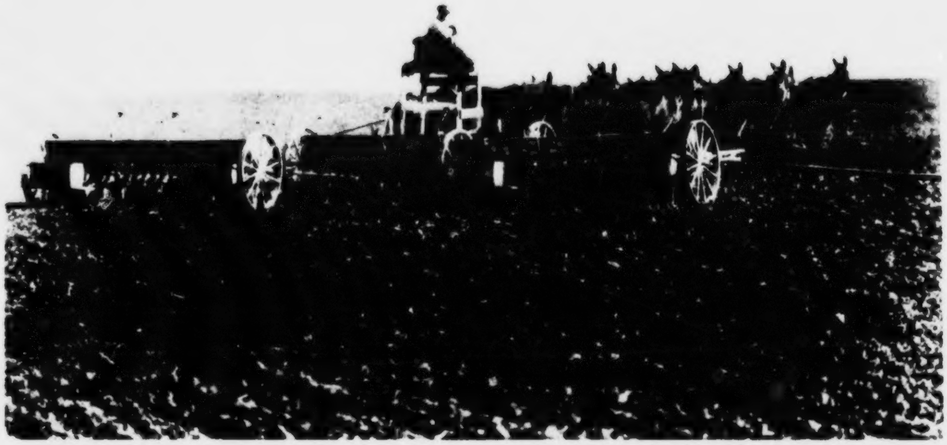

Figure 3. Seeding wheat using mule teams. (Saskatchewan Archives.)

By the early 1890s methods of seed selection and the principles of tillage were being articulated by prairie farmers. Although the advice given did not take into account the principles of moisture conservation in prairie soil, the suggestions demonstrated farmers' interests in obtaining maximum crop yields under semi-arid conditions. One farmer who concerned himself with seed selection and tillage procedures was F.L. Morton, M.P.P. from Gladstone, Manitoba. Writing in *The Nor'-West Farmer*, Morton declared that only the best grain should be used for seed. Sowing frosted wheat seed would meet with disastrous results. Certainly the frosted seed would grow, but under adversely dry conditions it would use up its store of food and the young plant would die. Morton also commented on tillage procedures. He suggested that in a sandy loam soil ploughing should be no more than five inches deep in the fall and only three in the spring. He explained the reasons for harrowing as fourfold: first, to loosen the soil so plants could extend their roots in search of food; second, to pulverize the soil to increase its absorbent capacity; third, to destroy weeds; and fourth, to open the soil for air and water.[16] No attempt was made to explain methods for preserving the moisture already in the soil, but explanations of this type were beginning to circulate and writings such as Morton's demonstrated that prairie farmers were well on their way to developing general cultivation techniques suitable for wheat growing.

The development and popularization of the press drill was one of the major accomplishments of pre-1900 dry-farming methodology. Before the late 1880s the broadcast seeder was in widespread use, but it had several shortcomings. Most critically, it left much of the seed on the surface and yielded no uniform depth of planting. The seed germinated prematurely under the slightest moisture, was eaten by birds, or was blown away by prairie winds. The press drill changed matters completely. It placed seed at a uniform depth and in a position where winds would have little effect.[17] *The Nor'-West Farmer* for September 1889 described the operation of the Superior Shoe Press Drill:

> The Superior Shoe Press Drill employs a series of runner-shaped shoes, placed at a proper distance apart, the heel or rear portion of the shoe being directly under the steel axle. The blades or runners are so shaped that the earth is opened up in the form of a trench with the least possible effort and at a uniform depth. To the rear of each shoe, and attached near the top of the casting or boot, is a covering and pressing device consisting of a series of large wheels, which pass over the furrow or trench, shaving down the sides of the trench with fine earth which properly fills the furrow....
>
> A saddle extends from the top of the press wheel to the boot of the shoe, and by changing the position of the spring pressure the weight can be put on the shoe, or all on the wheel, or partly on each....The levers for raising the shoes and applying the pressure are located in the centre of the machine and at the rear of the lopper. The depth of planting is entirely under the control of the operator, and is accomplished by means of the lifting levers and notches in the bracket.[18]

Prairie farmers were enthusiastic about the results achieved by the press drill. H. Sorby of Portage la Prairie planted 810 acres of wheat with the new device. His first quarter section was ripe some time before that of his neighbour who had used the broadcast method. Furthermore, his yield was two bushels per acre more than he had ever experienced.[19] The drill press, then, constituted an important advance in prairie agricultural technology because it placed seeds at a depth where uncontrollable factors would not interfere with the germination process.

Aside from the many technological advances made during the latter half of the 19th century, summer fallowing was probably the most important dry-farming technique discovered in this period. Apparently an Indian Head farmer, Angus MacKay, who later became head of the experimental farm, stumbled across the technique by accident during and immediately after the Northwest Rebellion. In the spring of 1885 MacKay was prevented from sowing his crops because his teams were needed to transport military supplies from Qu'Appelle to Batoche. In 1886 the fields of wheat, which he had been forced to leave fallow, yielded 26 bushels per acre. This contrasted sharply with the poor yield in the rest of the district in fields that had been cropped the previous year. MacKay was convinced that he had found a way of conserving moisture.[20]

At first summer fallowing became popular not as a means for preserving soil moisture but as a method of weed eradication and soil enrichment. In April 1886 A. Dryden of Ste. Agathe, Manitoba, wrote in *The Nor'-West Farmer*, "I think I am correct in stating that the object here is not so much to increase the fertility of the soil as to eradicate weeds."[21] Accordingly, the best method of summer fallowing was to plough at the end of June when weeds could be burnt out after a shallow topsoil turnover.

With a slightly different emphasis a regular contributor, "R.W.M.," argued that in a new country one must adapt farm work to its special conditions.[22] Weeds should be ploughed under during a fallow year to serve as plant food for next year's crop, a step which also helped in weed control. Summer fallow allowed for "the disintegrating action of sun and air upon unassimilated mineral and vegetable substances, which, for want of such action, have hitherto lain unused."[23] The first crop of weeds was allowed to germinate, and then when the majority of weeds were in bloom, they were ploughed under five inches or deeper. Early practitioners, then, were agreed that weed control and soil enrichment were the raison d'être of fallowing.

Controversy arose over the method of working the fallow. Some farmers believed that two thorough ploughings for the control of weeds were superior to one. F. Douglas Cooper of Souris, Manitoba, explained the issues involved:

> So far opinion seems to be divided as to the best method of summerfallowing. Whether one clean deep plowing in the month of July, or at any rate, as late as it can be done in order to prevent the seeding of weeds will suffice, or whether giving the land two plowings, the first when the weeds are well started to grow but still not too high for clean work, then harrowed and a second plowing about the end of July to cover in as late as possible any second growth which has started since the first plowing.[24]

Cooper favoured two fairly deep ploughings because weeds would be eradicated more thoroughly. However, in a dry year one ploughing about five inches deep would be more satisfactory.[25] The debate remained unresolved.

In the 1890s the idea that summer fallowing could be used as a means of preserving moisture began to spread. R. Waugh of Souris, Manitoba, wrote in *The Nor'-West Farmer* July 1891 that summer fallowing was the answer to the dangers of limited rainfall in a short growing season. It would leave the soil (if worked properly) in a position to preserve every drop of moisture.

> Summerfallow....is sure to leave the soil in fine particles, and the harrowing on the top helps to squeeze them together so as to have the whole cultivated layer on top of our land in the most perfect possible condition of what scientific men call capillarity, which, in plain English, just means that it is full of fine spaces, through, which water and air can circulate in all directions. If you lay down a dry brick or clod of earth on the surface of a dry field and tramp on it so as to bring it close to the dry earth below, you will find in a few days that the under side is damp, because the moisture from below has come up through the fine pores of the earth or brick and will stay there, supposing the sun has been shining on the top of it all the time.[26]

Angus MacKay, Superintendent of the Dominion Experimental Farm at Indian Head, agreed. He even developed a method to prevent the loss of moisture from the weeds grown on fallowed fields. He maintained that the fallow should be ploughed in May or June to prevent the weeds from using up the valuable moisture that the fallow was designed to preserve.[27] By the mid 1890s, then, summer fallowing was practised to preserve moisture, to eradicate weeds and to renew the soil.

The final achievement of 19th century prairie farm technology was the control of wheat smut by means of bluestoning. As early as 1891 R.K. Smith of Maskawata was experimenting with the technique. He

> emptied out 9 bus. of wheat [seed] on a clean board floor, dissolved a pound of bluestone in a pail of water, and then sprinkled over the pile of wheat with a broom the half of pail, turned and shovelled the pile thoroughly, afterwards putting on balance of pail, then turning again.[28]

Seeing that there were still traces of smut in his yield he used the same procedure the following year with only 8 bushels of wheat. It was, however, the technique that was at fault. *The Nor'-West Farmer* recommended placing an unspecified amount of bluestone in a barrel, inserting a bushel of wheat in a coarse linen bag and dipping the bag into the barrel, thereby immersing the wheat seed thoroughly. The seed would then be dried and not planted until at least ten days had elapsed.[29] This technique proved workable and virtually insured smut-free wheat for the future.

Thus, at the century's end dry farming had passed through its embryonic stage. Through experimentation Red Fyfe had been found for cultivation in semi-arid areas. The press drill had made its appearance eliminating the problems of wind, birds and early germination. Summer fallowing was being practised enthusiastically for weed control and as a means of preserving soil moisture. Lastly, bluestoning had been discovered, ending the problem of wheat smut. By 1900 all of the basic elements for successful dry farming were present.

During the years 1901-10 many of the techniques of dry-land agriculture became increasingly sophisticated. Land breaking and tillage processes such as ploughing, preparing the seed bed, and determining seeding depth all were developed with moisture conservation in mind. The proper use of disc harrows and ploughs in moisture conservation was widely discussed and seed selection was developed into an exacting science. At the same time the propagandists like the periodical press and the government experimental farms disseminated the new information on weed and smut control.

Angus MacKay, Superintendent of the Dominion Experimental Farm at Indian Head, Saskatchewan, developed a technique for breaking virgin land in 1909 that would preserve the moisture for a fairly lengthy time period. The traditional method of breaking was:

> to continue breaking three or more inches deep so long as the teams can turn over the sod, then in the fall to disc the top-soil and grow grain in the spring following. From the breaking so done before the end of June, a good crop of Wheat, Oats or Barley is usually obtained, but no amount of cultivation will ensure even a fair crop on this land in the next succeeding year. After the first crop has been

> cut the soil is usually in a perfectly dry state and remains so, in spite of any known method of cultivation, until the rain comes in the spring following. If they are insufficient or late, as is frequently the case, failure of the crop must be the result.[30]

MacKay's technique also involved backsetting which entailed, "turning the sod back to its original place, and at the same time bringing up two or three inches of fresh soil to cover it.[31]

Dry-land soils should be ploughed as shallowly as possible up to the end of June or early July. Then, in August or September, the land could be ploughed again "two or three inches deeper in the same direction and then harrowed to make a fine and firm seed bed," this after the sod had become rotted by summer rains and suns. The newly broken land would be good for two successive crops instead of the one possible under the old method. The second crop could be sown after the stubble had been burnt,[32] but the third year the land had to be summer fallowed. Using MacKay's method, dry-land farmers did not have to fear a crop failure during the second year on newly broken land. There would be sufficient moisture for two crops of wheat.

In 1910, a banner year for the new dry-land farming propaganda, several tillage processes designed to retain soil moisture after breaking and seeding were promoted through the press and local agricultural societies. In an address to a Farmers' Institute meeting at Vermilion, Alberta, a D.W. Warner recommended that breaking be done with the use of a soil packer following the plough in its preparation of a precise five-inch furrow.[33] The width of the furrow was supposed to be identical to that made on the same land in previous years "so it will fit in nicely and the connection can be made between that and the strata below the furrow slice, for by so doing we provide a good soil mulch in the breaking." Warner also recommended the use of a harrow or disc to fill in the crevice between the furrows.[34] He then dealt with the actual preparation procedures of the seed bed which were supposed to conduct moisture down into the soil and to help hold it there by preventing evaporation. On newly broken land the seed bed would have to be prepared during the summer or fall before planting, at which time discing perhaps three inches on top of the five-inch furrow would prove satisfactory. In the spring, on the other hand, the depth of seeding would be determined by the moisture line:

> We must sow deep enough to reach the moisture. If the seed bed is properly prepared and looked after up to the time of seeding, that line should be about from two to two and-a-half inches from the surface. That depth will ensure a more uniform germination as well as a more equal start for the young plant.[35]

Seed sown deeper than the water line would expend all its nourishment just trying to break the surface while seed sown too near the surface might produce no growth at all. These techniques were designed to allow the farmer to make the most of prevailing soil moisture when cultivating both wheat and other cereals.

During the first decade of the 20th century, a fairly prosperous era for the western farmer, the dry-land settlers began to acquire a broad variety of dry farming implements. Among the most important of

Figure 4. Discing and harrowing. (Saskatchewan Archives.)

Figure 5. Cultivator, ca. 1920. (Manitoba Archives.)

these was the disc. In the view of *The Grain Growers Guide* the plough was useful solely for turning the land over to bring fresh soil to the surface, while the disc pulverized the newly broken land, putting it in a proper condition for seeding.[36] Further improvements also made the disc important as a cultivator for cleaning a field of weeds. In the fall, many dry-belt farmers would disc the fields they intended to seed in the ensuing year to stir up the soil and start the weeds growing prematurely. Frosts would kill the new growth and provide a mulch which preserved soil moisture. In the spring, discing would be continued to loosen the soil without encouraging moisture loss through evaporation. The disc could then be used on the summer fallow to kill small weeds and to aid in packing the soil.[37] In short the disc had become the main tool in dry farming and was becoming so popular that in some instances farmers were substituting it for the plough. Consequently, *The Guide* had to temper its earlier enthusiasm with the warning that the disc should properly be used only as a pulverizer and a cultivator.

> When it is done in place of plowing the result is a failure. The disc will not take the place of the plow for the simple reason that it does not cut all the soil and does not go deep enough.[38]

The complexities of the application of summer fallowing to dry-land agriculture clearly would not allow for shortcuts.

Hand in hand with the development and application of new agricultural machinery at the beginning of the 20th century, the scientific process of seed selection and hybridizing was applied to the specific conditions of the prairie west by men like W.J. Rutherford and John Bracken. In 1907 both men described techniques that would vastly improve the annual wheat yields of prairie farmers.

W.J. Rutherford, writing in *Farm Crop* for May 1907, recommended planting large, plump grains rather than small ones because "the larger and plumper the seed the more food will be available to give the young plant a good start and put it beyond the danger point of drought."[39] Further, large plump seed also produced strong plants with large root systems while small seeds tended to produce "spindly plants with small root systems, slender stems and narrow leaves."[40] Since Rutherford viewed the use of poor seed as the main cause of low yields, he heartily recommended the use of the fanning mill and the grader in the sorting of seed grain lots.

In the January edition of *The Canadian Thresherman*, John Bracken had suggested that prairie farmers were well aware of the advantages of sowing good seed and that they were particularly interested in securing pure Red Fyfe wheat seed.[41] The main problem they faced, however, was obtaining Red Fyfe that was contaminated with weeds and inferior wheat varieties. "The presence of seeds from these plants makes the sample less uniform in color, size and shape of berry and very often lowers the quality or hardness." Bracken held that the remedy was not so much the fanning mill but "selecting typical heads from the stacking grain," and he outlined the following method:

> One day's work will provide sufficient pure seed to sow 1/4 to 1/2 an acre. This half will provide enough seed, if properly handled, to sow eight or ten acres the next year. Then if all foreign varieties have been removed from the growing plots, enough practically pure seed will result to sow the whole farm of the average grain grower.[42]

To obtain suitable seed the farmer should make selections not only from seed but from the parent plants. Secondly, he should sow a seed plot where the most vigorous plants could be grown under optimum conditions, and, of course, he should utilize proper dry-farming methods.[43]

According to Bracken's seminal article the qualities he should seek in the grain were hardness and plumpness. To achieve these two characteristics, the grain grower should prevent his wheat from becoming affected by rust, frost and weathering. He should never use mixed-wheat seed, concentrating instead on procuring the best Red Fyfe variety. Hardness was the quality that made Red Fyfe a desirable and marketable commodity. Plumpness was the quality that made any wheat seed favourable to high yields per acre.[44] The advice rendered by Bracken and Rutherford on seed varieties and characteristics produced immense gains in crop yield and, naturally, larger gross profits for the farmer.

Advances in the knowledge of weeds and methods for their control were also made during the century's first decade. Essentially a weed was defined as any plant growing in the wrong place.[45] Weeds were injurious because they crowded out the cultivated plants, robbing them of available plant food and moisture. Weeds found their way into fields by a variety of means such as wind, birds, animals and machinery, since threshing machines often spread weeds by being moved from a weed-infested farm to a clear one without proper cleaning.[46]

The more common weeds could be classified under three groupings, all determined by their lifespan. The first group were annuals, or plants which completed their growth in one year. "As a rule they have small fibrous roots and produce a large quantity of seed."[47] The main plants in this category were mustard, lambsquarter, pigweed and wild oats. The second group were the biennials. They required two seasons to mature, "the first being spent in collecting and storing up a supply of nourishment, which is used the second season in producing flowers and seeds." Plants in this category were false tansy, common evening-primrose and burdock. But the most troublesome group of weeds fell into the third category comprising the perennials. Living for many years and spreading from seed and underground stems, this group either had shallow roots, like couch grass and yarrow, or deep roots like Canada thistle, field sow thistle and blue lettuce.[48]

The general principles for weed eradication were elucidated in the May 1909 issue of *Farm Crops*:

1. There is no weed known which cannot be eradicated by constant attention, if only the nature of its growth can be understood.
2. Never allow weeds to ripen seeds.
3. Cultivate frequently, particulary early in the season, so as to destroy seedlings while small and easily killed.
4. Many weed seeds can be induced to germinate in autumn by cultivating stubble immediately after harvest. Many of the seedlings would be killed by winter or could be easily disposed of by plowing or cultivation in spring.
5. All weeds bearing mature seeds should be burnt, and under no circumstances should they be plowed under.
6. All weeds can be destroyed by the use of the ordinary implements of the farm, the plow, the cultivator, the spade and the hoe.
7. Be constantly on the alert to prevent new weeds from becoming established on farms. Handpull all new weeds or plants as soon as noticed.[49]

At the same time, a number of specific methods could be used to eradicate particular types of weeds. Growing barley for a season in place of wheat was a possible solution to the presence of weed annuals. Again, the field should be disced and harrowed immediately after its crops had been cut. Then, a late fall ploughing would kill many of the weak seedlings that had already begun their premature growth. In the spring the field should be harrowed to begin new weed growth and in the first or second week in May the field should be disced to kill weeds that had germinated. A late seeding of early maturing barley would complete the process:

> By sowing barley late, many of the weeds are killed by cultivation before the barley is sown. The warm weather at this season promotes the rapid growth of barley which checks the weeds and the barley will mature before most of the weeds, and will allow early fall plowing which is very desirable in killing weeds.[50]

If these methods failed or were not feasible, a bare summer fallow was suggested as another course. Using this method stubble fields would also be disced in the fall to bring about premature germination. Then, in the spring the land would be harrowed to promote further germination and in early June the land would be plowed to kill the weeds that were up. Annual weeds might also require a special process for extermination. Ploughing in the spring before these plants were about to flower, would cut them down and so weaken them that several cultivations would destroy their root systems later in the season.[51] All of these methods went far in helping prairie farmers to eliminate weed. Although the application of these anti-weed techniques required that a degree of judgement be exercised, they made an immediate impact on the quality and quantity of western crop yields. Likewise, the development of smut-control techniques was also having an impact on improved production. According to Englehart Steuck, W.R. Motherwell's neighbour near Abernethy, Saskatchewan, "the most important question before the grain grawers [sic] of the west at this present moment....is the method of avoiding smut in wheat - an evil through [which] millions of dollars are being lost to the people of Western Canada."[52] The disease was caused by a tiny plant which showed as "a black, dusty mass of stuff filling kernels of wheat, replacing whole heads of oats, and....ears of corn."[53] There were essentially two types of grain smut. Stinking smut destroyed only the kernels of the grain and emitted a repugnant odour. Loose smut, on the other hand, destroyed the chaff as well as the kernel. Wheat was susceptible to two types of stinking smut and a single form of loose smut. To treat both types of stinking smuts, the agricultural chemists improved the bluestoning process that had been developed in the 1890s. The wheat seed was initially immersed in a solution of 1 pound of commercial copper sulphate and 24 gallons of water for 12 hours. It was then placed in lime water for five or ten minutes after which it was dried on canvas sheets that had been spread out in the sun.[54] This more rigorous treatment of the seed grain ensured that no smut-infested grain could slip through the process.

Therefore, by 1910 a fairly comprehensive methodology for wheat growing had been collated and disseminated. Comprehensive analysis of the new techniques filled the farm journals and government reports. S.A. Bedford, Professor of Field Husbandry at Manitoba Agricultural College, stated his views in *The Grain Growers' Guide*, W.R. Motherwell, Saskatchewan's Minister of Agriculture, published his views on wheat growing in *Farm Crops* and his own departmental bulletins; while A.E. Wilson of Indian Head, Saskatchewan, synopsised wheat-growing methods in the *Annual Report* of the Saskatchewan Department of Agriculture.

S.A. Bedford believed that farmers should only cultivate Red Fyfe wheat. More importantly, once a farmer had obtained a supply of good seed he should not trade it with his neighbour unless the other farmer had a better sample than his own.[55] Even then a farmer ran the risk of having his fields infested with weeds from a neighbour's less pure seed. Bedford had also determined that wheat should be sown as early as possible to ensure a long growing season, but only after it had been bluestoned. Spring ploughing was recommended over fall ploughing because the stubble would collect snow during the winter months and increase the moisture available to the following year's crop. Land used for wheat also had to be summer fallowed regularly. The best method was to plough the land in June,

> harrowing or packing at once to encourage capillary action, and cultivating near the surface every few days until fall. This plan compacts the soil, starts all weeds that are near the surface, then kills them; it also leaves a good dust mulch near the surface to retain the moisture.[56]

W.R. Motherwell also stressed the importance of conserving soil moisture, using good seed and controlling weeds in his analysis of wheat growing. In his opinion soil moisture was the farmer's most important concern.[57] Summer fallowing should be carried out every third or fourth year to refurbish the exhausted soil with moisture. The selection of proper seed he ranked next in importance to moisture preservation. Up to 1906, farmers had paid scant attention to the quality of wheat seed sown, but from 1906 to 1909 "a vigorous campaign on behalf of better seed and greater care in the selection thereof....had the effect of arresting and turning public attention in the direction of improved conditions in this respect."[58] Third on Motherwell's list of proper dry-land farming was weed control and eradication. It was especially important to comprehend the full impact of weeds that robbed both the moisture and nourishment that could develop the growing crop.[59] With an understanding of their main points of wheat cultivation and soil moisture preservation there was, according to Motherwell, a good chance of success in dry farming.

Given the task of producing the 1909 *Annual Report* for the Department of Agriculture, A.E. Wilson provided a well-balanced account of wheat growing around Indian Head. Like the others he suggested that the best seed be used and that it be treated against smut infestation. But summer fallowing, in his opinion, was the key to successful wheat growing in the Indian Head district.[60] Care had to be taken to plough the fallow once or twice to prevent the land from becoming infested with weeds, and it had to be cultivated and packed to preserve soil moisture. It would seem from these accounts, then, that by 1910 the dry-land methods were both reasonably well advanced and relatively consistent.

By 1910 wheat acreage in Saskatchewan was fairly substantial resulting no doubt from advances in cultivation methods. In 1910, 4,664,834 acres were seeded in wheat and yielded an average of 15.5 bushels per acre.[61] This was a significant advance over the 9.1 bushel average taken from 382,540 acres in 1900 and made wheat the number one dry-land crop.

In essence, the changes that occurred in dry-land agriculture after 1910 were largely refinements of the procedures that had been developed over the previous 30 years. Moisture preservation became a fine art. The war against weed infestation was waged on a massive scale. And seed-selection techniques were worked to precision by scientific farmers like the renowned Seager Wheeler.

Wheeler, who farmed near Rosthern, Saskatchewan, believed that proper seed-selection practices were indispensible for increased yields. Too often he found that farmers were careless with fine wheats like the pure Marquis strains they had been given by the Dominion experimental farms. Contaminated and diluted by ill-considered threshing practices, few of these valuable seed lots survived the first two years of growth intact.[62] Standards were lowered by mixing red and white wheats, bearded and beardless wheats, wheats with difference in length and strength of straw and with inconsistent sizes and shapes of grain. The solution to the problem lay in setting aside a quarter acre each year as a seed plot. Such land should have been summer fallowed or planted with a potato crop the previous year. It should then be disced, lightly harrowed, levelled off with a plank drag, and finished "with the harrow or cultivator, leaving the land in a slightly ridged or corrugated condition to go into the winter."[63] In the spring the plot should then be harrowed after which between 20 and 25 pounds of seed could be sown and kept in isolation from the farmer's main grain fields. When the crop was ripe for selection, only the plump and well-developed uniform heads should be picked, and then only from the centre of the plot, since selections made from the perimeters would have had more sunlight and moisture. The seeds so selected would then be used for the following year's plot and within two or three years the farmer would have an adequate supply of the seed best suited to his soil and climatic conditions.[64] This use of a specific seed plot, represented a major advance over the simple selection of plump kernels from the wheat fields.

Similarly, more refinements were made in soil-moisture preservation technology after 1910, paralleling the advances in seed selection. Perhaps the most important of these was Seager Wheeler's advocacy of deeper ploughing techniques:

> The course stubble plowed under at the bottom of the furrow slice was an obstacle to capillarity. This was before the advent of the land packer. I now plow deeper in the spring using a small pulverizer attached to the plow, and the plank drag and land packer, and now have no reason to complain of the results, which are very satisfactory...[65]

According to Wheeler, the purpose for deep ploughing was to create both a root bed and a seed bed.[66] Deeper ploughing followed by immediate packing of the furrow and development of the seed bed also resulted in better moisture conservation and less soil drifting compared with a shallow ploughing of three to four inches. Moreover deep ploughing had the added benefit of bringing new soil to the surface. This new soil "is exposed to the influence of the elements that will pulverize and break it down, and unlock some of the plant food, and it is in the right place for this to be done."[67] But to engage in satisfactory deep ploughing the small packer had to follow the ploughs and was in turn followed by both the larger packer to firm down the furrow slice, and by the "plank drag" to level the field and make the surface uniform.[68]

Wheeler was also responsible for developing a method of preserving the moisture of melting snow in fields. On the whole there had been little concern with snow-moisture retention. Except on exceptionally flat fields most of the "snow water" ran to waste during the spring. This was particularly so on summer fallow where the runoff also carried with it "the finer particles of soil, principally the humus, from the higher to the lower levels or from off the fields altogether."[69] However, under Wheeler's system it was relatively simple. In the autumn a spring-tooth cultivator would be used on the fields to open up ridges and furrows. When the snows melted in spring the ridges would "act as miniature dams and hold back the water until it percolated down into the soil."[70] Some farmers had been prone to damming culverts and natural drainage outlets during the spring, but Wheeler's system was probably more efficient.

While Wheeler was busy putting his practical experience to good use, botanical laboratory work had made great strides in identifying the growing habits of the Canada Thistle, couch grass, wild oats, and stink weed, which were pinpointed in an effort to particularize weed control. The Canada Thistle was a difficult plant to eradicate because it was a perennial and could spread by root stocks as well as seeds. *The Grain Growers' Guide* recommended the use of a duckfoot cultivator to keep the leaves of this plant covered with earth, thus smothering its growth.[71] If only patches of the weed existed they could be covered with sacking or tar paper to exclude the light. Couch grass was another perennial that was difficult to destroy. Spreading by shallow root stocks and ready to produce new plants quickly, it was best destroyed by cutting with a disc harrow. This could be done at any time but the best stage for cutting was just before it prepared to flower, when the plant would be in its weakest stage of life.[72]

Among the annuals the most common nuisance was wild oats. Early spring discing of the infested fields was thought best because it encouraged the plant's premature growth, and the plant could then be killed on spring ploughing.[73] Stink weed posed problems of its own. As a result of a hard oily coating on the seeds the plant would remain viable for a lengthy time, and once in a field it was difficult to kill. The best way of eradicating small quantities was to pull the weeds by hand, afterwards burning them. If the infestation were widespread, however, fall discing, fall ploughing, and constant harrowing was necessary merely to keep the weed under control.[74] Nevertheless, it was just this kind of specific knowledge that the farmers needed to apply the appropriate remedy to the peculiar circumstances of different weed species.

Meanwhile agricultural chemistry and technology had combined to improve the efficiency of the smut-control techniques that had appeared before the turn of the century. Two machines had been developed, one that would bluestone wheat and another that would remove smut from infected grain. The bluestoning machine called a "grain pickler" operated,

> by a cog which is turned by hand, or a spiral thread on a cone shaped central axis which is free to revolve when grain runs onto it from a hopper. Into the worm box onto the top of the cone, a small stream of the liquid is allowed to trickle and this, when the grain is passed through, covers it thoroughly. The use of a pickler....ensures the thorough wetting of all the kernels.[75]

The device for cleaning smutted grains was designed to wet the grain thoroughly in a formalin solution:

> The seed is placed in the hopper and then passes into the formalin in the tank beneath. As it sinks to the bottom it is thoroughly wetted, while the smut balls, chaff, and light seed float on the surface and are removed by an automatic skimming device. The grain is raised out of the solution by the elevator, is drained as it passes up the incline, and is then dumped into sacks or receptacles to be removed and dried.[76]

The only drawback to the new machines was that they could treat only between 25 and 50 bushels of wheat per hour for both processes. Later developments, however, would improve their efficiency.

Machinery, of course, played a major role in the opening of the dry belt to modern agricultural mining. Three categories of machinery were most important to effective dry-land farming. Ploughs, soil looseners and soil firmers were all developed to take into account the peculiarities and moisture problems of prairie soils. According to John Bracken, the function of the plough was to cut off all the roots of plants, to turn the furrow upside down and completely cover all vegetation and litter, to pulverize the soil, to break up a hard subsoil, and to leave the surface as smooth as possible at the lowest possible cost.[77] To best accomplish these purposes the mouldboard plough was generally found to be most suitable because it pulverized the soil leaving a protective top layer. It came in a number of varieties such as "the sod bottom" (including rods for heavy gumbo), "the stubble bottom" (including slats for hard scouring soil) and "the general purpose bottom," all of which were generally interchangeable.[78]

Soil looseners completed the task begun by the mouldboard plough. Generally regarded as cultivators, their basic function was "to control weed growth and to loosen the surface soil in order to kill weeds or make a soil mulch or admit air."[79] Aside from the implements specifically designated as cultivators, "soil looseners" also included disc harrows and drag harrows. The duckfoot cultivator (wide-bladed) was designed to cut weeds below the surface of the soil. The disc harrow was used on stubble or ploughed land to loosen the soil surface in order "to conserve moisture,...to kill weeds, or to form a seed bed," and was particularly useful for prairie agriculture as it could be used for working down the prairie sod.[80] The drag harrow, on the other hand, was a simple device used only to prepare a level surface after tillage had taken place.[81]

The third category of dry-land farm machinery consisted of the soil firmers. The most common implement in this group was the packer which was designed to firm the top layers of soil to encourage the "movement of moisture from the subsoil to the furrow slice," or to bring the moisture of the soil "into closer contact with the seed or roots of plants."[82] In this sense the two most common types of packers were surface and subsurface: one bringing moisture to the top of the soil, the other affecting the soil only at a level where the deeper roots would benefit from capillary action.

At the end of a decade in which so many technological and methodological refinements had been made, both John Bracken and Seager Wheeler produced their most important treatises on the theories and methods of dry-land farming. *Seager Wheeler's Book on Profitable Grain Growing*[83] was written in layman's language and had the greatest impact on the prairie grain grower. While it detailed all apsects of dry-land agriculture, particular stress was laid on Wheeler's own method of deep ploughing and seed and root-bed preparation. Of course the central theme of the work was the use of all available soil moisture in the production of satisfactory crops.

John Bracken's *Dry Farming in Western Canada* followed the same lines as Wheeler's, but it was somewhat more technical in approach. In particular, Bracken's book covered topics such as moisture, tillage, breaking soil, summer fallowing, weed control, and low-yield causes in great detail.[84] Combined with the work of a practical farmer and a popularizer like Wheeler, it constituted the most complete expression of prairie dry-belt farming principles seen to that point. Following the publication of his book John Bracken entered a long and not indistinguished political career. Wheeler, on the other hand, parlayed his agrarian talents into continental fame as he propounded his grass-roots dry-land farming techniques.

Wheeler's Marquis wheat won for him his first award in the New York Land Show of 1911 when he captured the $1000.00 offered by the Canadian Pacific Railway for the best hard, red spring wheat grown on the continent.[85] In 1914 his Marquis wheat won the sweepstakes at the International Dry Farming Congress in Wichita, and in 1915, at the Denver International Dry Farming Congress, his Marquis was a repeat winner. At the same contest Wheeler entered his own Kitchener wheat variety for which he was awarded another first prize.[86] The Kitchener won again at El Paso in 1916, and by 1917 he had developed still another variety which he called Red Bobs.[87] That year he won first prize at the International Dry-Farming Congress and in 1918 the new strain won again at the International Soil Products Exposition at Kansas City.[88] Of course, Wheeler's achievements at local and provincial exhibitions were immense and by the 1920s, he had clearly demonstrated what could be accomplished by proper dry-farming methods.

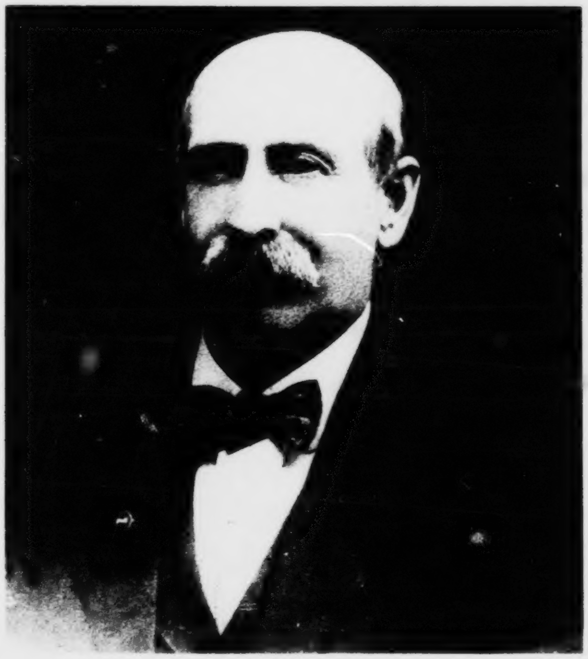

Figure 6. Seager Wheeler, ca. 1918. (Saskatchewan Archives.)

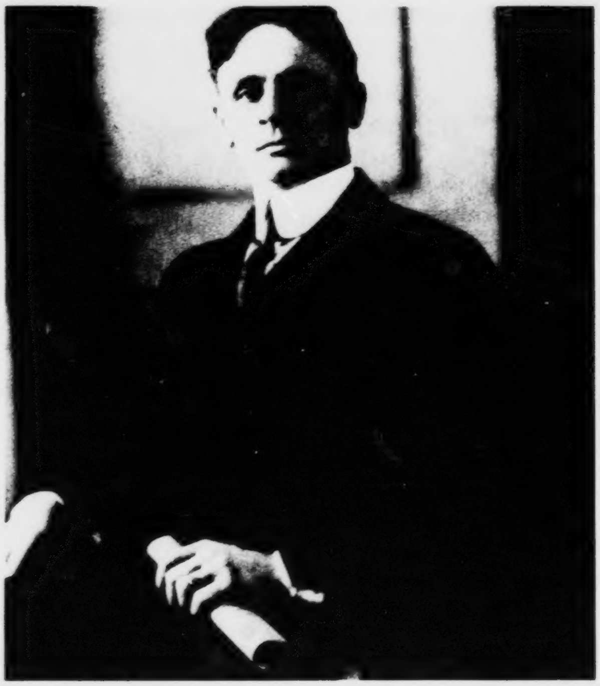

Figure 7. John Bracken, Professor of Agronomy and Soils, University of Saskatchewan, Saskatoon, ca. 1909. (Saskatchewan Archives.)

Nevertheless, as Ingles has so emphatically displayed, dry-farming techniques did not solve all the problems of dry-land agriculture.[89] By using all of the methods except summer fallow during the peak demand years of the first World War, western farmers had almost exhausted the fertility and moisture content of their soil. "In Alberta the average yield per acre of wheat dropped ten bushels, [in 1916] with the total yield decreased by 7,500,000 bushels."[90] Dry-farming techniques, then, were not entirely harmless. Ingles claims that,

> the soil had been harrowed to death. Where farmers had produced a soil mulch to conserve moisture, a dust powder covered the fields and again blew freely in the slightest breeze. Packers which had become popular during the peak of dry-farming promotion had pulverized the soil. Furthermore, repeated gang plowing to a depth of seven to ten inches had broken down the fibre of the soil and had facilitated drifting.[91]

Clearly, although the dry-farming methods had made prairie agriculture profitable it had also sown the seeds of its own destruction, giving the right combination of climatic circumstances.

Despite the low yield per acre on wheat lands, expansion continued unabated and by 1919 more acres were sown with wheat than in any previous year.[92] Following the war, however, a modicum of sanity had returned, and in 1920 more acres of land were summer fallowed (4,395,746) than in any previous year.[93] In 1918 Saskatchewan ranked fourth on the North American continent in the production of wheat, oats, barley and flax behind Illinois, Minnesota and Iowa.[94] The large acreage can only be linked to dry-farming techniques. Had soil-moisture preservation methods not been developed, planting such large acreages would have proved uneconomical as the return in crop yields would have been minimal. As things stood, however, a fair return was possible. After the war the vision of huge profits once again gripped prairie agriculture. The reduced 1919 yield of 8.5 bushels per acre, compared with the more normal 1911 yield of 18.5 bushels per acre,[95] was attributable to the wartime demands that had placed suitable lands under cultivation and had drained the strength of those lands already being cropped. With renewed faith in the capabilities of dry-land techniques, and with a new-found sense of the fragility of their land, western farmers entered the twenties with a firmer grasp of the dry-land methodology and an inclination to preserve their precarious grasp by diversifying their production.

SUPPLEMENTING WHEAT WITH OTHER CROPS

From 1880 to 1920, some effort had been made to supplement wheat with other crops like oats, barley, flax, alfalfa, bromegrass and red clover. While oats and barley and to a lesser extent flax did supplement wheat, they never replaced it as the principal crop, primarily because wheat remained the most profitable. The seed and specialized machinery costs were high and there were other major practical problems in cultivating alfalfa, bromegrass and red clover. Yet some farmers pursued crop innovation, aggressively producing a considerably body of experimental data.

One of the most contentious practices that arose out of the early era of western agriculture was the use of crop rotation to preserve fertility. John Bracken defines crop rotation as "a more or less regular succession of crops of different kinds on a given field or farm, designed to result in a larger net return or some improvement of the soil."[1] According to McKillican, Superintendent of the Dominion Experimental Farm at Brandon, crop rotations should include a cash crop convertible to capital after harvest, a cleaning crop or fallow for the purpose of restoring soil moisture, a fodder crop designed to provide livestock feed, and a leguminous crop to "restore nitrogenous fertility to the soil."[2] In short, the two men were proposing that a form of mixed farming could be used on the Prairies to increase soil fertility which, in turn, would increase production.

Most dry-belt farmers, however, practised a simple type of summer fallowing with alternate crops rather than the more complex crop rotation. According to McKillican's research at Brandon, the majority of Manitoba wheat growers would plant wheat twice, sow oats the third year and leave the land fallow during the fourth.[3] But he had found that the results from this system of planting had been poor and advised against its use:

> This rotation has the fallow for a cleaning season, has three cash crops, but no fodder crop unless the oats are used in that way, and no leguminous crop. By means of the fallow it conserves moisture and makes plant food more readily available for the crop that follows, and attempts at least to control weeds. It makes no attempt to return anything to the soil, so that gradual depletion and increased tendency to blow are the inevitable results. During the time that prairie soils are giving up their virgin fertility, good results are obtained from this rotation....[4]

The ideal type of rotation pattern was virtually a system of mixed farming. The first two years wheat would be planted, the third year oats and barley, and the fourth hay (red clover or bromegrass). The fifth year the land would be left as pasture, and in the sixth year corn would be seeded.[5] Since it was recognized that corn might not be practical because of early frost, another possibility was suggested: year one - wheat, year two - wheat, year three - fallow, year four - oats, year five - hay (clover and grass), and year six - pasture.[6] Either system was supposed to restore and improve soil fertility, but the economic utility of the method was rapidly brought into question since wheat cultivation was allowed only twice in six years.

Some thought that the answer to these problems was alfalfa, a leguminous forage crop.[7] While alfalfa has relatively little value as a cash crop, its intricate root system choked weeds from the fields, it produced on the average over five tons of forage per acre, it supplied the soil with nitrogen during its growth period, and when ploughed under, it added humus to the soil. At the same time, its roots extended 10-12 feet, bringing sub-soil moisture to the surface.[8] Ingles is highly critical of prairie farmers for not adopting what he terms an alfalfa rotation system:

> Yet initially, the wheat farmers themselves took little interest in these experiments. They did not feel the need for alfalfa as a forage crop, for prairie grasses, still abundant in sloughs and hollows, provided enough food for the existing herds of livestock. Furthermore, these same farmers did not seem convinced about the necessity of maintaining the fertility of the soil on their farms.[9]

But Ingles has also ignored the major drawbacks of alfalfa of which the western farmer was quite aware. The implementation of a viable crop rotation system was clearly dependent upon the use of an alternative money crop to wheat.[10] Farmers were businessmen. They had to meet their mortgage and farm machinery payments. Most farmers knew about the detrimental effects of continuous wheat cultivation, but losses on wheat profits outweighed the possible advantages of crop rotation. W.C. McKillican, for one, suggested that a proper rotation pattern would produce a substantial wheat crop only two out of every six years, oats would hardly prove profitable and alfalfa would cost more than it was worth since it lacked a viable market. In short, any rotation pattern geared to soil replenishment constituted a direct path to bankruptcy. Farmers were hardly being backward when they chose the course of financial solvency and gradual soil depletion.

While the supremacy of wheat was never seriously challenged by other crops, significant acreages of oats, barley and flax were sown. Alfalfa, bromegrass and corn, which were strongly urged as wheat supplements, never achieved the same popularity. In spite of zealous efforts by the propagandists and the experimental farm staffs, wheat remained king.

Oats were the main supplementary crop on the prairie dry belt. By 1910 oat acreages equalled roughly half that of wheat, a position the crop maintained until the 1920s.[11] According to John Bracken, "in the chief wheat growing regions oats are sown after wheat and generally as the last crop before fallowing."[12] Its purpose was to serve as a cleaning crop before the summer fallow, but it did not return depleted nutrients to the soil as did leguminous crops.[13] Seeding for oats was recommended as soon as possible after spring ploughing and a good harrowing. The land was then packed and harrowed.[14] Banner was the standard variety of oats between 1910 and 1920. "Heavy yielding," Banner had a fine, strong straw and a "slightly compressed" head; the grain was white long, medium plump and possessed "a high percent of kernel."[15] But Banner also had a major weakness in that it was late in ripening.[16] Nevertheless, it served as the standard cleaning crop after two years of wheat cultivation.[17]

W.R. Motherwell, Saskatchewan's Minister of Agriculture between 1905 and 1918, was widely experienced in oat-cultivation techniques. He recommended seeding 2-2 1/2 bushels of oats per acre: "More than that would likely reduce the yield per acre while less would have a tendency to develop too much stooling and too late maturity."[18] Insofar as the date of sowing was concerned, Motherwell recommended deeper rather than late seeding to avoid the ravages of earlier frost. This would ensure a more prolonged germination and a hardy root system that would ensure new growth even if late frosts killed the top of the plant. Under these conditions Motherwell was quite prepared to sow a portion of his oat crop during the first half of April, while holding the rest of his seed for later planting as a hedge against disastrous killing frosts.[19]

Ranked behind oats as a preferred crop, barley claimed the third largest acreage in the dry belt between 1900 and 1920. Showing steady increase in the acreages planted throughout the period, barley, like oats, slumped briefly not during but after the war in 1919. While production in that year had dropped off more than 35 per cent from 1917 yields, barley managed to maintain its position as the third most important prairie crop.[20]

Barley was generally grown in the West as a cleaning and feed crop. John Bracken recommended its use:

> (1) where wild oats are a serious menace as in parts of southern Manitoba and south eastern Saskatchewan (2) where there is danger from early fall frosts, as in the northern parts of all three Prairie Provinces, and (3) on fields that cannot be prepared early enough in spring for wheat or oats.[21]

Barley was an excellent cleaning crop. It ripened so quickly "that many weeds [did] not have time to mature their seeds before harvesting, particularly when early varieties [were] used."[22]

Barley was not, however, without its drawbacks. It produced a weak straw when grown on rich soil, its heads had a tendency to break off, and its seeds a tendency to shatter. The most suitable of the many varieties of barley for dry-belt cultivation were the two-row varieties such as Duckbill and Early Chevalier.[23] Land intended for barley cultivation was recommended for fall ploughing. "Turning the soil at this season of the year leaves it exposed to the frosts of winter, and it can be cultivated and handled much more readily the following spring."[24] Where only spring ploughing was possible, it had to be undertaken early. The land was then worked down with a disc and harrow, and a packer was used to firm the soil. After treatment against smut, barley seeding was carried out in Saskatchewan between May 5 and May 20, and on most soils 1 3/4 bushels were used per acre.[25] The crop was

Figure 8. Oats, ca. 1906. (Saskatchewan Archives.)

Figure 9. Registered barley at demonstration farm, Birtle, Manitoba, August 1927. (Manitoba Archives.)

harvested early before it was well ripened, since it was grown for feed and there was likely to be greater loss from broken heads and shattered seed in mature grain than from weight loss in earlier harvesting.[26]

Unlike barley and oats, the problems attending the production of flax revolved more around its marketability. Fourth on the list of crop popularity, flax made its first appearance in the North-West Territories in 1902. By 1910 its popularity had increased to such an extent that the 238,394 acres planted in Saskatchewan alone produced 5,859,018 bushels, and in 1919, flax replaced barley in significance in that province.[27]

Flax was cultivated mainly for its seed which produced linseed oil which was used in the manufacture of paints and linoleums, and oil cake, a stock feed.[28] For dry-belt cultivation the best varieties were Premost or Minnesota No. 25, both of which had been developed at the Minnesota Experiment Station.[29] The general rule of thumb for successful cultivation was late planting. On newly broken land, flax could be grown in the same manner as wheat. On land previously used, spring-ploughing was recommended for the drier districts, provided the seed was sown immediately with a press drill and a packer.[30] Since flax seeds were generally smaller than grain seeds, shallower ploughing, 1-1 1/2 inches, was recommended, and the amount of seed sown per acre varied widely. At Saskatoon 20 pounds per acre was recommended while at Indian Head, 40-50 pounds yielded the best crop.[31]

The greatest drawback of flax was the lack of a stable market for flax seed, linseed oil and flax straw. Thompson, Sons & Company, Winnipeg Grain Commission Merchants, explained the precariousness of the 1910 market in a letter to the Saskatchewan Deputy Minister of Agriculture:

> The oilcrushing business in Canada has never grown to a great industry, probably because the oil required for domestic use in the earlier days was not large, and there would be practically no demand for oilcake. In the eastern part where the bulk of the oil would be needed, it could be easily imported from Europe at probably less cost than it could be manufactured from home grown seed, and the fact of the moderate cost of imported oil, and the habit of getting it from that direction, no doubt tended to stifle any probable efforts to raise sufficient seed to employ the manufacturer....The great development all over Canada in the last few years in the matter of railways, general building and manufactures, must have increased the demand immensely for linseed oil, but even yet, we do not think Canada required much over one million bus. of seed to supply her own requirements.[32]

Although a substantial demand for flax seed existed, in the United States, this was judged to be temporary. Farmers were cautioned that any attempt to exploit the market would probably produce a glut and American prices, at once so close yet inaccessible, would collapse.[33]

The use of flax for linen production in Canada was treated in much the same way. W.W. Thomson, Acting Weeds and Seed Commissioner in Ottawa, wrote Charles N. Brisbin of Holden, Alberta that in Saskatchewan "the growing of flax for fibre purposes cannot be considered a commercial enterprise,....mainly because there does not appear to be any market to which the fibre could economically be shipped."[34] This was confirmed by the 1917 financial failure of a linen plant in Rosetown, Saskatchewan.[35]

Like flax, corn did not achieve a wide popularity on the prairie dry belt, although it could be used as a paying substitute for the summer fallow. The Longfellow variety could thrive in dry areas and the experts recommended that light loam soils be ploughed as early as possible, then harrowed and packed.[36] "The seeding itself was to be undertaken about May 24, in three foot drills with the seed left three to six inches apart. Approximately half a bushel of seed could be sown per acre at a depth of two to three inches depending upon the dryness of the soil." The main problem in corn cultivation was its susceptibility to frost since "even a slight touch....seriously reduced the value of fodder corn."[37] It was this uncertainty that served to deter farmers from planting the crop to any great extent.

Nevertheless, corn cropping gave rise to one of the most interesting interventions by the debtor banks in the Canadian West. With the support of all prairie branches, the Canadian Bankers Association made an attempt to encourage farmers to grow corn on their fallow land in 1916 to avoid a repetition of the 1915 crop failure, so that the heavily indebted western farmers could at least meet their interest charges:

> There is no sentiment in this proposed action of the banks,....many thousands of grain growers in the prairie provinces owe money to the banks and we are naturally anxious that they should all be in a position to pay this next fall. The condition this spring will be very much better than it was last spring in the matter of moisture. If sufficient work is done by our grain growers to preserve the moisture that is already in the ground, a failure of the crop of 1915 from drought would be impossible."[38]

Corn was seen as the answer. The banks would provide selected seed free of charge to all farmers who undertook to grow one acre of green fodder using instructions provided by the various provincial departments of agriculture.[39] The Canadian Pacific Railroad would provide a 50 per cent discount on freight rates on all seed forwarded by the Bankers Association to each of their bank managers.[40] And the Saskatchewan government would provide free leaflets containing instructions on corn growing to be distributed at local bank branches.[41] But the scheme produced no dramatic increase in corn production, and the crop was destined to remain only of peripheral importance on the Canadian prairie.

As a high-yield, drought resistent crop bromegrass had shown more potential than corn but was eventually relegated to the same insignificance. A perennial, brome produced more green feed in dry summers than any other grass although it grew rather slowly in the first year, its best yield occurring in the third.[42] For best results the Indian Head Experimental Farm recommended 10-12 pounds of seed per acre. Bromegrass was, however, not without its disadvantages. In the eyes of the western farmer the largest of these was the three-year maturity of the crop, which meant the loss of two wheat years in a bare fallow system. Moreover, once the plant had established itself it became persistent and was considered a weed nuisance by some. Only the most thorough cultivation practices could suppress it, making its utility questionable.[43]

W.R. Motherwell was something of a pioneer in bromegrass cultivation, and he fully recognized its limitations. As early as 1901 he had begun seeding the crop and continued its cultivation with some success as a forage crop to 1910.[44] In 1909 he produced 120,000 pounds of seed from 150 acres[45] for which he apparently had a ready market. From 1901 to 1904 Motherwell sold his seed to Albert Dickinson Seed Company in Minneapolis, and between 1905 and 1908 his buyer was Steele, Briggs Company in Winnipeg.[46] Despite his success with the crop, Motherwell felt that bromegrass had a number of objectionable characteristics. He claimed that it was a nuisance around trees and gardens,[47] and he found that its seed was virtually impossible to clean. Fortunately, he was able to sell his seed uncleaned to both his Minneapolis and Winnipeg buyers,[48] but at the same time, his criticism of bromegrass constituted a serious indictment of the crop and may have contributed to its failing popularity in the West.

Alfalfa,[49] on the other hand, was billed as the answer to farmers' dreams. At the height of a 1912-15 promotional campaign by the agricultural press for increased alfalfa acreages, its virtues as a soil enricher and livestock fattener were widely extolled. *The Grain Growers' Guide* emphasized the increase in value of the crops succeeding alfalfa, claiming that the value of wheat crops could be increased by $8-$12 per acre, and oats and potatoes by $16 per acre.[50] *The Guide* then cited the case of an Alberta rancher, George Lane, to illustrate the properties of alfalfa as a livestock fattener:

> Who has not heard of the big Yankee rancher, George Lane, whose land holdings south and east of Calgary look like a township, and who annually imports cargoes of pure bred horses from Europe? With a twinkle in his clear blue eyes, and a broad smile of contentment, Mr. Lane tells why he fell in love with alfalfa. It was because he found this plant would fatten three times as many horses, steers, hogs, etc., as anything else he could grow. Like many other progressive farmers in Western Canada, Lane does things somewhat on the wholesale plan. Thus, for instance, when planting alfalfa, he lays out the fields by sections. Just now he is feeding alfalfa to 3,500 steers, some so large that they tip the scale at almost a ton. This is why Lane glories in Alfalfa.[51]

In every 100 pounds of alfalfa hay there were 11 pounds of protein and 39.6 pounds of carbohydrates.[52] By comparison, 100 pounds of clover hay yielded 6.8 pounds protein and 35.8 pounds carbohydrates, and timothy hay 2.8 and 43.4 pounds, respectively. As a consequence, alfalfa's nutrition translated into a substantial market value. Alfalfa hay sold for $20.16 per ton in 1914, while clover brought only $5.96 and timothy $9.80.[53] Of course, the higher alfalfa overhead costs tampered the enthusiasm of the western farmer who remained unconvinced about the benefits of sacrificing potential wheat years to fodder crops.

Alfalfa was also a complicated crop to produce. Only Grimm's variety could be used on the Prairies because it would withstand dry summers and cold winters.[54] Furthermore, for best results Grimm's had to be seeded only on summer-fallowed land, and special precautions had to be taken to ensure that the seed was completely free of impurities.

> The seed is so small that it takes approximately 200,000 to weigh a pound. If 15 pounds per acre is sown there will be approximately 75 seeds per square foot. It is therefore apparent that a small percentage of noxious impurities will badly infest a farm. The presence of one per cent of weeds is enough to put one weed on each one and a quarter square feet of a whole field.[55]

The ground had to be pulverized and sown close to the surface,[56] with seed that was costly and usually contained impurities that were difficult to remove.[57] Innoculation of the prospective alfalfa field with soil from an old field was a time-consuming task and the required soil was expensive. It took at least two years to procure a harvest because premature cutting could destroy the tender root system. Then, at the end of two seasons all a farmer had was a fodder crop that was probably not remarkable. High overhead costs and the loss of at least one year's wheat crop made the investment in alfalfa production as questionable as it had for the other crops that were billed as competitors to wheat. Only oats and barley were grown in any real quantities: oats because of its ability to clean fields while producing a viable fodder crop; and barley because it was hardy enough to make marginal lands relatively productive. Flax, on the other hand, was restricted by limited markets, while corn, bromegrass and alfalfa were costly to cultivate, difficult to raise and on the whole uneconomical. There was really no alternative to wheat.

In the periodical press, horticultural advice was freely offered to homesteading farmers and as early as the 1880s gardens became an integral part of the prairie farm. Farmers were advised to locate their gardens near their homes, with the gardens sloping to the south and sheltered from the north.[58] It was recommended that the land be broken about four inches deep in the first week in May at the latest in preparation for the great variety of garden seed available to the farmer. It was even possible to cultivate tomatoes and cucumbers, with the assistance of a hot bed. Tomatoes, it was advised, should only be planted in a sheltered portion of the garden and only after there was no risk of frost. Cucumbers could be raised in the same manner. Care had to be taken to give them air to harden well before planting in a moist part of the garden, dusting frequently with ashes to prevent ravages from insects.[59]

During the early 1900s significant advances were made in gardening technology, the most important being the introduction of moisture conservation methods, the perfection of hot beds (Appendix A) and improvements in garden tools. To preserve soil moisture it was recommended that an earth mulch be laid down an inch or so deep in the uncultivated spaces.[60] Soil cultivation was suggested as soon after a rain as possible never allowing it to dry so that it would crumble.[61] If a crust were allowed to form evaporation of the sub-surface moisture would be accelerated.[62]

New tools were developed solely for use in large farm gardens. Several one-horse cultivators with various-sized teeth and shovels were available by 1907: "In working the crops while they are small the harrow

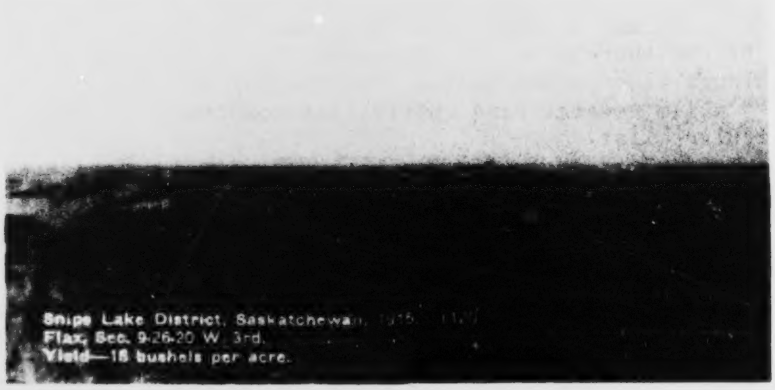
Snipe Lake District, Saskatchewan, 1915.
Flax, Sec. 9-26-20 W. 3rd.
Yield—16 bushels per acre.

Figure 10. Flax, Snipe Lake District, Saskatchewan, 1915. (Saskatchewan Archives.)

Figure 11. Alfalfa, Manitoba Agricultural College, 1925. (Manitoba Archives.)

or smaller teeth may be used, and later when the plants become larger the size of the shovels may be increased."[63] A standard one-horse turning plough also proved useful "for running off rows or throwing up ridges,"[64] while several hand cultivators completed the tool kit of the horticulturalist.

Farm gardening, then, had become relatively sophisticated and by 1912 most farmers were seeding their gardens. Virtually all types of vegetables including radishes, lettuce, parsley, cabbage, cauliflower, beets, carrots, onions, and spinach were being grown, along with tomatoes and pumpkins.[65] Hot beds were being used extensively for preparing tomatoes and early cabbage for transplanting, large gardens were being ploughed and harrowed with horse-operated implements, and in total, horticulture had become an integral part of dry-belt farming.

MECHANIZATION

While in 1885 oxen and horses were the principal source of agricultural power, by 1920 breaking, ploughing and threshing were all mechanized. Horse breeders were unable to keep pace with the rate of new breakings, and steam was introduced as a supplement. This form of energy was so expensive that few farmers could afford their own power units and had to rely on the now legendary custom ploughmen and threshermen. From 1910 to 1912 the lightweight gasoline engine made its appearance along with the separator. With this new power source the farmer was well on his way to self-sufficiency with regard to threshing and ploughing.

Introduction of the Steam Plough and Threshing Machine

The first draft animals introduced to the Prairies were oxen, whose chief merit was their cost and ability to fend for themselves. They were half the price of horses and could forage off the Prairies if need be.[1] Yet within the first few years of the settlement they were replaced by the horse, especially the Clydesdales, dominant until 1920.[2]

The draft horse could deliver more power than the oxen but it was costly. Consuming "one pound of grain per day for every hundred pounds of live weight,"[3] a 1600-horse would eat 16 pounds of grain per day: four in the morning, eight at noon, and four at night, supplemented of course by fodder in the evening.[4]

Steam-driven ploughs and threshing machines first appeared on the Prairies in the 1880s. The first one in Regina, capable of four miles per hour, caused quite a stir. In July of 1885 about 200 people gathered near Kildonan (Winnipeg) to watch the demonstration of a steam-ploughing device invented by an Englishman, E. Ingleton, and powered by an engine owned by Capt. Colquhoun of Stoney Mountain.[5] The newspapers were detailed in their praise:

> The engine is of twenty-five horse power, burns half a ton of fuel in ten hours work, employs two men, one to drive, the other to carry water and fuel, is a traction engine quite capable of hauling itself and any load up to ten tons attached, moves from one to five miles per hour, can travel over plowed or soft land...The plows work at right angles with the engine, travelling on an endless belt, and at the trial were cutting a slice fourteen inches wide, two inches deep, and thirty-three feet long, doing about one and a

> half acres per hour, and doing it better than the ordinary breaking of a sulky or walking plow...It is hard to see where any improvement can be made upon the plow, though, doubtless, as in all other inventions, time will provide some.[6]

In August 1885, the plough was being demonstrated in the Brandon area.[7] Steam-powered threshing machines were introduced concurrently although Farquhar McLean began using one in the Portage la Prairie area as early as in 1874. Moose Jaw had one by 1884 and three were shipped to Edmonton the following year.[8]

Portable steam engines for agriculture originated in the United States in the late 1840s when A.L. Archambault of Philadelphia commenced building threshing engines in 4-, 10- and 30-horsepower sizes, ranging in price from $625 to $2300. By the 1860s he had been joined by J.C. Hoodley of Lawrence, Massachusetts, and Joseph Enright of San Jose, California.[9] Reynold M. Wik, an authority on the subject, offers the following description of the engines that would provide steam power for prairie agriculture:

> Although somewhat crude in appearance, the portable engines built in the 1850s possessed all the basic features necessary for successful operation. They were self-acting, with tubular boilers, governors, safety valves [sic], and a forced draft. Most of them were simple in construction.[10]

The acquisition and operation of these steam units was a tricky business. There were a few who could operate a machine profitably, but they were exceptional. One pioneer operated a 20-horsepower Sawyer-Massey traction engine with a 36 Peerless Sawyer-Massey thresher. A knowledgeable pioneer described the engine as simple in design.

> It was manually fed by two men called "feeders," who cut the sheaf bands with a knife and fed them as uniformally as possible into the machine. It was equipped with a straw carrier which, when in threshing position, was about 20 feet long and elevated the straw, as it came from the thresher, to the height of about 16 feet and allowed it to drop in a pile, which upon reaching the height of the carrier was dragged away, by means of a "buck pole" drawn by a horse at each end. It also had a bagger, as in those days grain was handled in cotton bags that held about two bushels of wheat.[11]

The operation of a threshing outfit may have been simple in principle but there were many difficulties in actual operations. Starting the steam engine was complicated and demanded "considerable know-how, if trouble was to be avoided."[12] In the early morning the engineer would determine the water temperature in the engine's boiler head. If the temperature was high, starting could be accomplished fairly quickly. The first real task was to open the smoke box door at the front of the boiler and "with a flue cleaner, clean the boiler flues by forcing the cleaner back and forth through the full length of each flue until all soot was removed."[13] Usually there were 20-30 flues, 2-2 1/2 inches in diameter to clean. Ashes and cinders had to be removed from the firebox with iron hoes or pokers[14] before the engine was ready for starting.

> The water gauge would be turned on and water level checked, then a forkful of dry straw placed in the straw shute and set alight and pushed gently into the fire box, the dry straw was then fed as fast as the straw burned; it was important to keep the straw shute full by gradually and steadily pushing in fairly large fork fulls....into the straw shute. All dampers were opened to give free access of air to the fire box.[15]

After firing, the engineer was required to turn his attention to the steam gauge. Cold water would take 20-30 minutes to boil, warm water a few minutes. When the gauge reached 5 pounds per square inch the blower would be turned on. O.S. Longman, a knowledgeable pioneer, described its operation.

> The blower, consisted of a quarter inch pipe leading directly from the boiler to the smoke stack, terminating with a fine nozzle pointing upward in the center of the stack, and controlled by a valve, usually operated from the rear of the engine. Up to now the straw has been burning by natural draught, however when the blower is turned on a jet of steam injected into the smoke stack creates a forced draught, and immediately the vigor of the fire is intensified, and as the steam pressure increases the noise of the blower grows louder; the draught through the fire box increases and the demand for straw in the fire box mounts.[16]

When steam pressure reached 140 pounds the blower would be turned off. Lubricators or oil pumps would then be filled with the proper oil, and the machine was prepared to operate.

The next major task was to connect the engine to the threshing machine or separator. The separator would be placed in front of the engine connected by an endless belt, 8-10 inches wide, 50 feet long and made of either canvas, rubber or cotton.[17] While the engineer was setting the engine the belt was pulled out full length, and the engine fly wheel positioned in line with the master pulley on the thresher. The engineer would climb to the stationary fly wheel, which was about 40 inches in diameter, reach for the belt and with one foot on the main drive shaft he would pull the belt over the top and edge of the fly wheel, where he would hold it with the firearm and others when necessary. The fly wheel with the belt would be given a half turn and the belt would be on.[18] With the basic connection complete a host of minor functions had to be performed. A large number of rubber belts had to be installed on the separator. The stacker had to be turned into position and, "the feeder unfolded and made ready for operation."[19] Various parts of the separator required oil and finally the straw rack had to be drawn to the rear of the thresher. Threshing could now begin.

Early threshing operations were dangerous to both man and machine. Frequently an overtired workman would lose grip of his pitch fork which would accompany the wheat into the machine, badly mangling the fork and engine.[20] More dangerous were the exposed belts and pulleys on the engine and separator. Limbs were too often lost to carelessness. Fire was always a hazard. Sparks could light the prairie grass, ignite the straw pile, and destroy the day's fuel supply.

Maintenance of the New Farm Machines

Both steam engines and threshers required knowledgeable individuals as operators. Most important was the engineer. While responsible for organizing and supervising operations, his main duty was to keep the steam engine in running order.

> It was no simple task to remove the crust that had been left in the boiler by hard prairie water, or to caulk and replace flues which had become clogged. If the machine broke down the engineer often had to work all night repairing it for the following day's operations.[21]

The engineer was flanked by the separator man. "His responsibility was to keep the separator running smoothly. He was constantly working on the machine, oiling bearings, lacing and setting the tension of the belts, and adjusting the cylinders and sieves in accordance with the dampness or dryness of the straw, the number of weeds, and the kind of crop."[22] Requiring less skill but necessary for the operation were the fireman, tankerman and bundlemen. The fireman was responsible for building up fire in the engine, while the tankerman hauled water to the engine and kept engine water level sufficiently high. "Bundlemen, as the teamsters were called, drove their wagons from stook to stook, loading the sleaves and hauling them to the separator."[23]

A successful custom threshing or ploughing outfit required carefully trained men, an astute accountant and most important a good engineer. *The Canadian Thresherman* suggested that the farmer considering entry into the steam-ploughing business select one of his sons or a trustworthy and competent ploughman.[24] The potential custom operator should then secure employment for his future engineer for a full season before actually purchasing equipment himself. After the machine had been selected the *Thresherman* recommended that the engineer be sent to the factory:

> So that he may become thoroughly acquainted with the construction of the machine, learn to use the various tools required, and especially important it is for him to acquire a knowledge of black-smithing, in fact let him keep his ears and eyes open and take in all he can.[25]

In the field the engineer should have complete charge of the men under him. In fact, to encourage proper management, the engineer should be given a portion of the profits.[26] Keeping meticulous daily records of all work done was an absolute necessity to determine profit or loss at the end of the season. The engineer, *The Thresherman* suggested, should be responsible for completing a day sheet, including such data as details of equipment breakdowns, and adverse weather conditions affecting operations. For his part the owner should keep a requisition book listing all purchases, as well as invoices and receipts.[27] Good business practices were essential to profitable operation.

An inadequate water supply was the most frequent cause of inefficient operations. It was suggested that the operator sink a well on some central spot on his farm and erect a windmill and tank.

> The tank should be sufficiently large to allow for

> contingencies, such as calm setting in, windmill or pump giving out, etc., it should be placed high enough to allow for the water being run direct into the horse tank, this would do away with the slow and laborious work of hand pumping. By having the outlet considerably higher than the bottom of tank, all grit and dirt raised by the pump would settle below the point from which the water was drawn, thus ensuring much cleaner water for the boiler. This would mean a great saving in expense for repairs.[28]

To haul the water to distant locations, two teams and tanks would probably be required. A reliable water supply could make or break an operation.

One of the most important pieces of equipment in steam operations was the thresher or separator itself. It consisted of:

> the separator proper, in which the separation of the grain from the straw takes place; the automatic self-feeder, which is generally adjusted so that the separator cannot be overloaded with straw at any one time, and the blower or wind stacker which disposes of the straw after the grain has been completely removed from the head.[29]

The first process performed by the separator was to remove the kernel from the head. E.J. Trott described this mechanical operation in the following manner:

> Accordingly an open cylinder, made of bars in which a number of teeth are placed, has been arranged so that it revolves at a high speed and beats the heads of the grain as they pass thru. This cylinder is quite heavy and performs the same function in the separator as a flywheel does in a gasoline engine, that is, when revolving rapidly it gathers a large amount of momentum and thus has sufficient force over and above that which is supplied to it to handle any small overplus of work which it may occasionally be subjected to.[30]

Behind the cylinder, the concaves were located.

> These are an arrangement of bars in which teeth similar to those in the cylinder are placed between which the cylinder teeth pass....The concaves are so placed that they may be raised or lowered at will so as to close or widen the space thru which the straw and grain will pass that is being threshed.[31]

Another important device through which the shelled grain passed was the beater.

> An arrangement so placed so as to flatten out any bunches of straw which may come thru so as to evenly distribute it over the whole surface of the straw racks so that it can be properly shaken, thus allowing any loose grain which it may contain to fall thru onto the shoe below.[32]

The straw rack was next on the grain's path. This device shook the straw thoroughly, thereby releasing all loose grain. The shoe was now on the grain's path. The shoe consisted of two sieves. The upper sieve's function was "to separate most of the chaff and any odd straw from the rest of the grain so that the under sieve will be free to clean the grain properly."[33] The grain was then fed to the wind stacker. This was an attachment that disposed of the straw. The only other component worth mentioning is the automatic self-feeder which initially fed unthreshed grain to the machine.

The equipment available to the steam plowman was extensive. Steam engines were sold in sizes ranging from 25 to 30 horsepower[34] and were produced by a plethora of manufacturers, with J.I. Case the leader. Huber, Aultman - Taylor, Geiser, Minneapolis, and Port Huron were also important manufacturers.[35] A wide variety of ploughs was also available. Among mouldboard ploughs, the farmer had to choose between steam-lift ploughs and hand-lift ploughs. Steam-lift ploughs consisted

> of several gangs of four to six plows hung on a single frame, each gang being lifted and dropped by means of a cylinder supplied with steam from the engine. Plows of this type usually contain eight, ten, or twelve 14-inch bottoms, though larger sizes are built for special sorts. Compactness and the possibility of backing and twining in close quarters have made the steam lift plow popular, though the first cost is greater, ranging from $900 to $1,500 for ordinary sized gangs.[36]

Less desirable were hand-lift ploughs. Smaller in size than the steam variety they were raised and lowered by levers mounted on the frames. They retailed for $100 for three furrows and $200-$250 for six.[37] In addition to engines and ploughs, a custom operator required miscellaneous tools. A coal wagon sold for $75, tank wagons holding 10-16 barrels retailed for $75-$200. A necessity for making field repairs, a set of blacksmithing tools set the operator back $20-$50.[38]

Driving a traction engine required certain knowledge and skills. Initial movement should not be made without the cylinder cocks open. The throttle should not be taken with a firm grip. A light hold on the throttle between the thumb and finger would prevent sudden lurches which could destroy the cylinder or cylinder head.[39] While connecting the tractor to a grain separator in a strong wind, the *Thresherman* recommended:

> setting the entire engine from one to four feet out of line with the separator toward the direction the wind is coming from; this will keep belt running well on cylinder pulley; then face the fly-wheel so that the rim nearest the separator will be quite a little out of line with separator in the direction wind is going so this will keep belt on engine fly-wheel. In strong gusts it might be well to place a fork handle half-way between separator and engine so that the belt will touch it only when a strong wind comes. At all other times care should be used to make the line as near perfect as possible.[40]

Steam threshing itself was a tedious procedure. In an average-sized threshing operation, at least six teams of horses were required to haul grain to the separator. If the separator did not have an automatic feeder, grain had to be fed by hand. Generally two teamsters using pitchforks were responsible for this operation. The grain could only be inserted with the head pointing towards the cylinder. Otherwise serious damage to the engine would result. At the rear of the separator a man was also stationed. His job was "to buck the straw away from the rear of the separator as it dropped from the straw carriers after being elevated about 8 ft." Other men were also employed as tankermen feeding the engine with water or as labourers loading and unloading grain.[41]

Steam engines and threshing machines had to be cared for in the off-season. A well-lit shed with plank flooring was required if the outfit was to survive the winter unscathed. Soon after the engine was placed in the shed, a thorough cleaning of its exposed parts was recommended.[42] "Carefully scrape off all dirt and oil and scale from the boiler and engine. Then paint the smoke stack with a good coat of asphaltum paint."[43] The mechanical parts of the engine would be serviced next. The water should be blown from the boiler with a low pressure blast of steam. The boiler's innards should be washed and several quarts of black oil inserted as a rust-proof coating. The separator also required servicing. Its exterior should be properly cleaned. A mixture of machine oil and kerosene was required as a rustproof coating.[44] Now the machine was ready for winter storage.

When all costs were considered, steam ploughing was as economical as animal ploughing. The *Annual Report* of the North-West Territories Department of Agriculture estimated the costs of horse cultivation in 1903 (cost is per acre):

Breaking	$3.00
Backsetting	2.00
Discing	2.00
Harrowing, 4 times at 25 cents	1.00
Total	$8.00[45]

On an overall basis steam ploughing was judged to be more economical.[46] The following figures for cultivating 20 acres were cited (cost is per day):

Engineer	$3.00
Assistant	2.00
Ploughman	2.00
Oil, etc	1.00
Coal	7.50
Hire of team	5.00
Interest, wear and tear and depreciation	7.00
Backsetting, at $2.00 per acre	40.00
Discing	40.00
Harrowing, 4 times at 25 cents	20.00
Cost for 20 acres	$127.00
Cost per acre	$6.40[47]

Cultivating by steam resulted in a saving of $1.60 per acre.

Threshing by animal power was simply not feasible. It was impossible to thresh the vast prairie acreage using oxen or horses

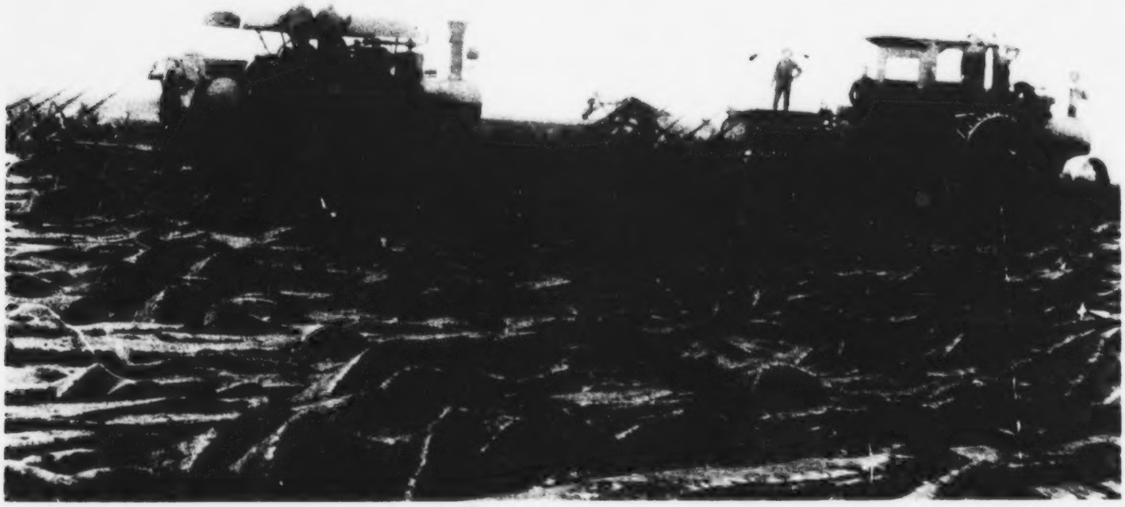

Figure 12. Breaking land near Weyburn, Saskatchewan. (Saskatchewan Archives.)

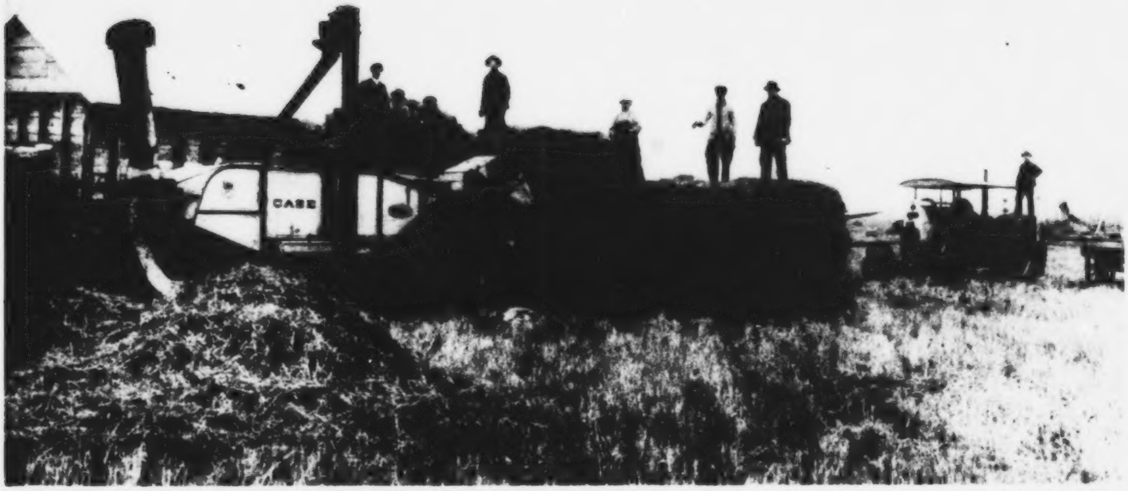

Figure 13. Threshing on a farm near Olds, Alberta, 1912. (Glenbow-Alberta Institute.)

walking up treadmills to turn grain separators. By the turn of the century steam-powered threshing was seen as the only way of completing the prairie harvest. Steam power had become a fact of farm life before 1910.

Most custom operators were quite pleased with the results obtained with steam ploughing. A.M. Thompson of Vegreville, Alberta, felt that his Sawyer & Massey engine had done excellent work in 1906. With his ploughs he had managed to average 20 acres per day on land that was considered heavy prairie. He suggested that "the whole secret of plowing by steam is to get an engine that is easy to steam and lower the price of the cost of the work."[48] The Du Bois brothers of Dundurn, Saskatchewan, found that steam ploughing was profitable. They used "five men in breaking and four in old land, using them as follows: engineer, man to steer, tank man, and one plowman on old land and two on breaking."[49] Their coal was purchased by the carload from Crow's Nest, Alberta. With their Waterous double cylinder engine rated at 26 horsepower and four Massey-Harris ploughs, they were able to average 25-30 acres per day.

An operator from Fielding, Saskatchewan, was similarly pleased with his operation. He owned a 25-horsepower Waterloo engine which pulled four two-furrow horse ploughs. An engineer with 20 years experience, he taught his eldest son to handle the engine, another son to act as fireman, and a third son to maintain the water level in the tank. Burning locally obtained wood instead of coal he managed to plough about 15 acres per day.[50] However, all custom operators were not as pleased with steam power. A ploughman from Pasqua, Saskatchewan, remarked that steam ploughing was efficient but extremely costly.

> The engines are so heavy that the ground has to be perfectly dry before they will work. Then the fuel costs so much and you can only get about half of the time you are burning coal in plowing. What with steaming up and letting steam down, taking coal and water at ends, and cleaning plows, perhaps sticking in a soft hole now and again, you lose a lot of time.[51]

The writer recommended that farmers continue to use horses until a more efficient mode of power was developed. In short, steam operations were efficient but had their shortcomings.

The era of steam power came to an end in 1912-14. Fuel was becoming scarcer and more expensive "and it requires good fuel to generate steam for the monster engines now required to do the heavy work of the farm traction engine, especially during the cold weather."[52] Moreover, securing a water supply for the engine could result in hauling water long distances in dry weather. The weight of the engine also constituted a hazard. These heavy contraptions could cause bridges to collapse, resulting in injury or death to users of the machinery. Above all, a new engine had appeared with several advantages over the steam engine: the internal combustion engine.

Introduction of the Gasoline Tractor

The gasoline tractor superseded the steam engine after 1912 because it had a number of distinct advantages. For a given weight, its manufacturers claimed, it developed more horsepower than its steam-powered rival. Another supposed benefit was easier starting. Barring mechanical difficulties all that had to be done was to apply the ignition and turn on the fuel flow.[53] Perhaps the greatest asset was the advantage of using gasoline or kerosene. Less bulky to haul than coal or wood, liquid fuel was much more practical for daily use. Moreover, there was no water-guzzling boiler with which to contend.

Gasoline-powered tractors made their first successful appearance in the United States in 1902-3 when Charles W. Hart and Charles H. Parr began constructing Hart-Parr tractors at Charles City, Iowa.[54] Others soon followed suit. "In 1907 there were about six hundred tractors in use in the United States, one-third of which were Hart-Parrs with the rest divided among the Kinnard-Haines Company of Minneapolis, the International Harvester Company of Chicago, Transit Thresher Company of Minneapolis, and several smaller concerns."[55] As the advantages of gasoline traction became known, more firms entered the market. The Rumely Company of La Porte, Indiana commenced manufacture of the "Oil Pull" at the rate of fifty per week by 1912. J.I. Case, Aultman-Taylor, Gaar Scott, Avery, and Reeves were manufacturing gasoline tractors as well as steam engines in 1911.[56]

Early gas-powered tractors were heavy, unwieldy and difficult to start. Many of the machines appeared on the market with designs similar to the steam engines they were supposed to replace. Like steam tractors, their gasoline counterparts were heavy, weighing 20,000-50,000 pounds with gigantic flywheels, some tipping the scales at over a ton.[57] Their weightiness caused them to bog down in the prairie soil. Another problem was difficult starting. Reynold M. Wik states that the instruction manual provided by the Hart-Parr Company listed 19 rules to follow in starting the engine and 13 for stopping it. Above all the tractors were unreliable. Wik mentions cases of farmers who spent $500-$1500 per year on servicing and repairs.[58]

The light tractor introduced in 1913 in the United States by a small unknown firm, was a definite improvement. In 1914, 14,500 tractors were manufactured and in that year were placed on the North American market. By 1917, a production figure of 90,000 units annually was being realized.[59] When J.I. Case, the largest manufacturer of steam engines, converted to the internal combustion engine, the light tractor was on the market to stay.

In 1908 there were less than 400 gas tractors in the Canadian prairie west. In 1911, 4000 gas tractors were operational compared with 4800 steam engines. In 1911, over 1800 gas tractors were purchased by prairie grain growers.[60]

> Inside of three years practically all of the old line steam traction firms operating in the Northwest, have put a gasoline or kerosene engine on the market or have an engine nearly ready for this year's trade. Great factories for

> the manufacture of gas tractors have sprung into existence within the past few years, and bid fair to rival the old steam traction factories in size and producing capacity.[61]

In 1912 gasoline traction had begun to supersede steam.

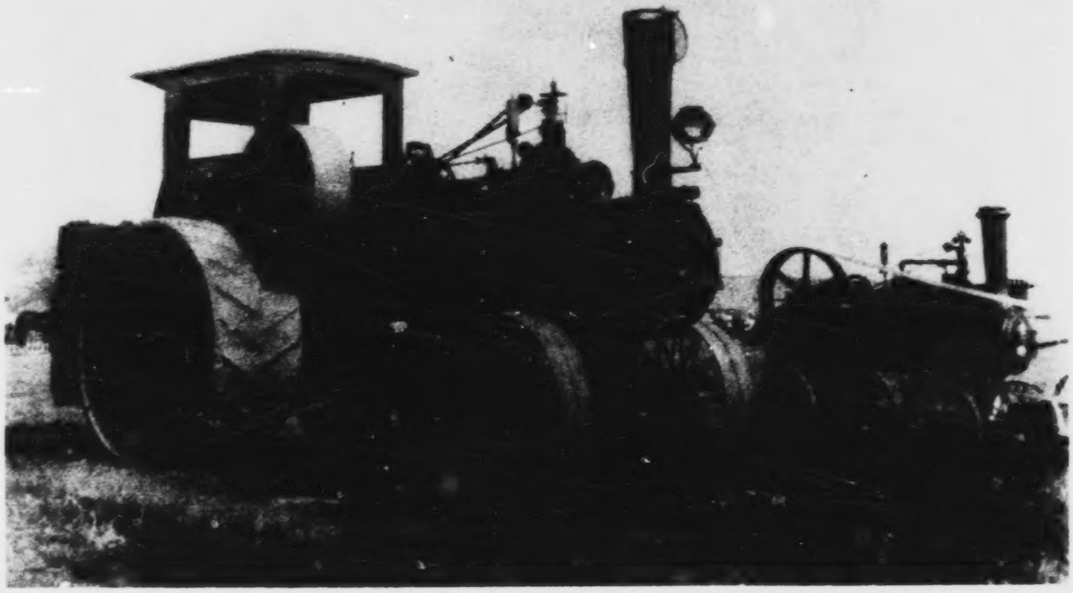

Figure 14. Case steam tractor, unspecified Alberta location, 1912. (Glenbow-Alberta Institute.)

Gas-powered threshing differed little from steam threshing. The separator remained the same; the only difference occurred in terms of mechanical power. An average engine, one developing 20-45 horsepower, was fitted with a dry battery and magneto. The engine was usually oil-cooled and burned low-grade kerosene, retailing for 10¢ per gallon at rural Saskatchewan points. To start the engine, gasoline was used. The crew required for threshing was slightly smaller than that needed for a steam engine, since the engineer could operate the tractor by himself, eliminating the need for a fireman and tankman. Otherwise the threshing crew remained the same. A sizeable number of teamsters were still needed to haul stooks to the separator and men were still required to feed unthreshed grain into the machine. A threshing outfit could hope to operate from early morning to sunset, threshing 1900 bushels of wheat on an average day and 2150 bushels when conditions were particularly favourable.[62]

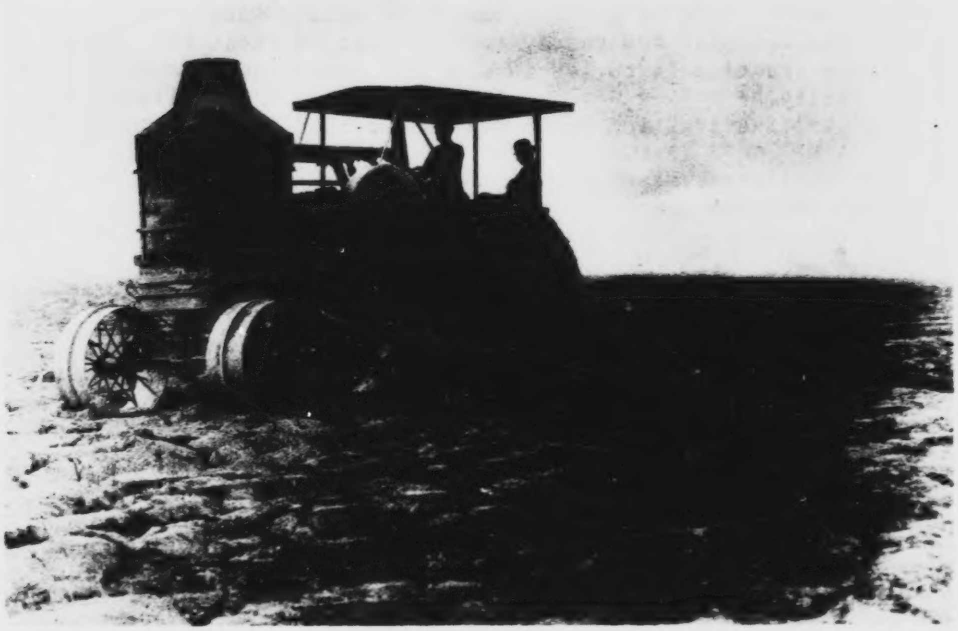

Figure 15. Rumely oil-puli tractor, "scrubbing" near Regina, n.d. (Glenbow-Alberta Institute.)

To keep a gasoline-powered tractor operational in 1912, proper servicing was required regularly. *Gas Power Age* recommended that the tractor be examined carefully at the end of a day's work. All loose nuts should be tightened, the cooling system cleaned, and water and oil kept up to their proper levels.[63] In cold weather the oil-cooling system of a tractor should be watched carefully:

> The water will freeze and split pipes and jackets, causing expensive repairs. The oil may become semi-solid and cease flowing to the pump. This can be prevented from occurring the second time by adding first-class kerosene to slightly thin the cooling oil. This cooling oil level should be noted.[64]

Generally it was recommended that the farmer inspect his tractor carefully after a 2 1/2-hour work shift. "Any defection is noticed and repaired. If parts are broken, the cause is investigated and when repairs are made, they are made that the same break does not occur again from the same cause."[65] If a tractor's mechanical parts were not scrutinized carefully, a good reliability record could not be expected.

Both gasoline and kerosene have their advantages as fuel. *The Grain Growers' Guide* estimated that kerosene was cheaper and that the farmer could save $1.08 per day through its use.[66] Kerosene was also more easily obtainable outside major centres. However, it had to be mixed with water and if the combination was not right, the engine would emit black smoke and fuel consumption would increase dramatically.

For its part, gasoline delivered 30 per cent more power than an equivalent quantity of kerosene. As important, fuel consumption was lower. Gone also were the problems of mixing the fuel with water. Gasoline's main shortcoming was its expense - 33 cents per gallon compared with kerosene's 20 cents.[67] By 1920, neither fuel had triumphed; tractors were still being built to operate on one, the other, or both.

By 1912 there was no doubt that gasoline tractor operations could be profitable. The cost of ploughing averaged $1.25 per acre. *The Grain Growers' Guide* estimated that the average day's work for a fair-sized tractor would be about 20 acres, which under favourable conditions means that an entire 320-acre farm could be turned over in a little over a fortnight at a cost of $400. The gasoline tractor was also found to be more versatile than its steam-powered brothers. Its generally lighter weight made it possible to use it for seeding, cultivating and reaping. The tractor could also be used for transporting heavy loads. Hauling grain to the nearest railroad point by tractor would take significantly less time than using a team of horses.[68] These advantages were not unnoticed by prairie farmers. In 1912, 9000 gas-powered tractors were in use in Manitoba, Saskatchewan and Alberta. At an average price of $2800, the total investment in gas-powered machinery totalled $25,200,000 by that year.[69]

The question now remained, What type of tractor should a farmer buy? *The Grain Growers' Guide* recommended a standard 15-horsepower model for the average-sized farm.[70] This type of tractor would do everything that a four-horse team could do; it "is easily handled, will not readily mire, can be used economically to run the chopper, wood-saw and, belted to a line shaft, many other handy devices by means of which farm work can be considerably lightened."[71] The only disadvantage to purchasing any tractor was the prospect of relatively quick depreciation. In short, the farm periodicals were convinced of the gasoline tractor's usefulness by 1915. Only the most desirable type of tractor for the average farmer remained in doubt.

From 1915 to 1921 farmers moved to self-sufficiency in ploughing and harvesting. The light gasoline tractor in combination with the small separator became increasingly popular. As mentioned earlier, the small tractor became popular because it was a jack-of-all-trades on the farm. The separator became an accessory that was connected to the tractor at threshing time to save the costs and inconveniences of hiring a custom operator. While a custom thresher would require at least a dozen men in his operation, the farmer required only two or three labourers to help him with the final stage of his harvesting. Moreover, the farmer would do his threshing when he saw fit, not when the custom operator decided.[72] The farmer's risk of losing his grain to fall frosts was thus eliminated. The appearance of separators designed for use with 15-horsepower tractors made this possible. Working a full day the farmer could expect to thresh 500-600 bushels of wheat - grain that was uncontaminated with another farmer's weeds.[73] The farmer was becoming increasingly self-sufficient.

The years 1880-1920 were momentous in the evolution of prairie farm mechanization. The cultivation of vast acreages necessitated the development of steam power to supplement ox and horse. During 1900-12, steam power became practical for ploughing and threshing. By 1912, however, the disadvantages of steam power had been made obvious by the perfection of the internal combustion engine. The gasoline engine led the way to improved farm efficiency and the turn toward farm self-sufficiency. The development of the portable separator sealed the fate of custom threshermen. By 1921, just four decades after the initial settlement of the prairie dry belt, farmers were able to break, plough, cultivate and thresh vast acreages with little outside help.

EFFECT OF AGRICULTURAL SOCIETIES AND AGRICULTURAL COLLEGES ON FIELD-CROP PRODUCTION

In the 40 years following 1880, a considerable effort was made by agricultural societies and colleges as well as implement dealers to educate the prairie farmers in dry-land farming methods. While from 1890 to 1906 there was little interest in formal programmes because farms were widespread and homesteading was the consuming task, after 1906 interest became considerable. There was, in fact, hardly a farmer left untouched by the agricultural lecture circuit. The result was a marked improvement in farm technique and production.

Agricultural Societies in the North-West Territories

Before 1893, Farmers' Institutes in the North-West Territories were confined to Moose Jaw, Whitewood, Wallace (in the Yorkton area), North and South Regina, Souris and Wolseley,[1] and local agricultural experiments conducted for the North-West Territories' Department of Agriculture generated little public interest. While farmers were beginning to attend lectures on farm improvement by 1903, real interest remained minimal until after the opening of the Manitoba Agricultural College in 1906.

The earliest propagandist and farmers' organizations were the Farmers' Institutes, created in 1890 by Ordinance No. 8 of the Territorial Assembly. The ordinance authorized their function to encourage agriculture, horticulture and arboriculture by

> (a) holding meetings for the discussion of and hearing lectures on subjects connected with the theory and practice of improved husbandry or other industrial purposes; (b) promoting the circulation of agricultural, horticultural, arboricultural and mechanical periodicals; (c) importing and otherwise procuring seeds, plants and animals of new and valuable kinds; (d) offering prizes for essays on questions of scientific enquiry relating to agriculture, horticulture, arboriculture, manufactures and the useful arts.[2]

The ordinance of 1890 also granted aid to the Institutes equal to the annual contribution of its members.[3] The Institute meetings, held in various towns, dealt with broad topics. On November 24, 1893, Angus MacKay addressed a meeting at Wolseley on general agricultural subjects.[4] The following day, MacKay spoke at another meeting in Grenfell where questions were raised by the assembled farmers on tree-planting, bromegrass growing and summer fallowing.[5] Despite such gatherings, however, the various Farmers' Institutes really accomplished little.

Somewhat akin to the Institutes, local agricultural societies initiated limited experimental programmes under the direction of the Territorial Department of Agriculture. The 1898 *Annual Report* of that Department offered the following rationale for its programme:

> Scientific research on a large scale is being conducted by the Federal Government at the central experimental farm at Ottawa, at Brandon and at the Indian Head farm. But in order to bring home to the farmer, residing probably hundreds of miles from these institutions, the valuable conclusions reached, it would be well to advance one step further and establish an experimental station in each such district of the Territories of uniform climate and soil conditions. Arrangement might be made with the best man available in each district to devote from ten to twenty acres of his property, which should be conveniently situated, to experimental work, and to conduct this work at a stated sum per annum...I am of the opinion that in view of our present sparse settlement, undeveloped state and limited revenue, we can well afford to rest content with a system of experimental or demonstration stations on the lease system, devoted to the merest A B C of agricultural inquiry and leave the question of extensive experimental farms until we are in a position to establish agricultural colleges with a proper scientific staff, without which such farms must of necessity be incomplete.[6]

In 1902 the proposal received action. Each agricultural society was asked to appoint, at its annual December meeting, an experimental committee of three directors to make arrangements for local experiments. Twenty-three societies responded.[7] Farmers designated locally were paid by the societies with government funds and provided with seed by the Territorial Department of Agriculture.[8] The experiments met with mixed results in 1903. Many of the field trials were successful while in other cases, "the ground selected for the plot was so foul with weed seeds that the experiment proved a failure."[9] Moreover, tests were only conducted on wheat, corn and various leguminous crops; difficulties in obtaining oats and barley led to the cancellation of some experiments.[10] By 1906 results were no better. Only 15 men experimented with various types of corn.[11]

Not all districts had Farmers' Institutes,[12] and the Territorial government, conscious of its responsibility to educate all farmers in new techniques, encouraged the lecture. In the 1903 *Annual Report of the Territorial Department of Agriculture*, lecturers were encouraged to make their presentations comprehensible to their audiences - The introduction of a song or recitation tends to relieve the monotony sometimes."[13] Lecturers were instructed to speak plainly and simply and at various points to illustrate their lectures with charts or illustrations. "Farmers are keen observers and accustomed to using their eyes. They cannot always remember the points of a long discourse, but if charts or illustrations are used to enforce certain ideas or points they quickly grasp the meaning and it is more firmly fixed in their minds."[14] Audio-visual techniques were also introduced:

> Since joining the department a lantern outfit has been obtained, one known as the Bright White Light. It throws a large-sized picture with a clear definition and can be successfully used in small halls and school houses. The light is a very bright one, produced by vaporizing coal oil under pressure in a special attachment and burning the gas produced in an ordinary Welsbach mantle. Slides illustrating typical animals of the various breeds of live stock have been obtained and additional ones will be secured from time to time. Slides also of injurious and beneficial insects, weeds, various forms of plant life and growth, etc., will be obtained so that talks along almost any line can be illustrated.[15]

Actually it was with the use of illustrated lectures that agricultural institute activities expanded. In 1901 meetings were held at such locations as Innisfail, Red Deer, Didsbury, Wetaskiwin, Ponoka, Lacombe, Yorkton, Moose Jaw, Whitewood, Lumsden, Wolseley, Wapella, Gainsborough, Moosomin, Abernethy, Indian Head, Sintaluta, Rosthern and others[16] - 77 lectures were delivered by a number of prominent agricultural experts including Angus MacKay, Superintendent of the Dominion Experimental Farm at Indian Head.[17] Two years later the total had expanded to 106.[18] The lecture circuit appears to have reached a considerable and widespread audience.

In 1903 agricultural societies and Farmers' Institutes in the North-West Territories were amalgamated under the Territorial Agricultural Societies Ordinance.[19] Under the new regulations the reformed agricultural societies were made responsible for lectures, encouraging improved field husbandry techniques, holding agricultural fairs and conducting experiments in line with government instructions.[20] As in the past, the Territorial government provided the funding,[21] but while general farming practices were improved, no real strides were made in scientific experimentation.

Agricultural Colleges on the Prairies

After 1906 the agricultural education movement experienced a marked growth. All three Prairie provinces established agricultural colleges - Manitoba in 1906, Saskatchewan four years later and Alberta in 1914. Universities conducted agricultural extension courses aimed at dry-belt farmers, dealing with such topics as traction engineering and dry farming. The agricultural societies for their part continued to sponsor lectures, field experiments for the Saskatchewan government, and local agricultural and seed fairs. Manufacturers of tractors also endeavoured to provide complete courses at various locations on the operation and maintenance of their machinery. Even correspondence schools entered the scene and offered commercial courses in dry farming.

Lastly, an American organization, the International Dry Farming Congress, disseminated its particular information, receiving substantial economic support from the Saskatchewan government.

The direct ancestor of all prairie husbandry institutions was the Ontario Agricultural College at Guelph. Established during the 1870s, its objective was "not endeavouring to teach boys how to farm, but to take boys with farm practice and teach them better methods."[22] Moreover, the college engaged in experiments and conducted extension courses in agriculture throughout Ontario.[23] The O.A.C. educational tradition became a base for prairie agricultural college activities.

The curriculum at the O.A.C. was detailed and complex. In 1881 the programme became oriented toward the achievement of the two-year Bachelor of Scientific Agriculture (B.S.A.) diploma of which W.R. Motherwell was one of the first recipients. That year the first segment of the B.S.A. program was divided into three sessions: the Fall Term running from 1 October to 22 December, the Winter Term from 5 January to 31 March, and the Spring Term 16 April to 30 June.[24] Courses were given in five departments: 1) Agriculture and Live Stock, 2) Natural Science, 3) Veterinary Science, 4) English Literature and Composition and 5) Mathematics.[25] The first-year agriculture and livestock courses constituted a general introduction with such topics as soils, buildings, farm implements, crop rotations, animal husbandry and field husbandry.[26] Under the heading of Natural Science, subjects such as basic chemical physics, inorganic chemistry, and zoology were taught, while in Veterinary Science the anatomy and physiology of farm animals, including horses, hogs, sheep and cattle was introduced to the students. English literature and composition stressed structure and style in paragraph and essay writing.[27] Mathematics was oriented in a practical direction concentrating on farm bookkeeping and business organization. A student's first year at the O.A.C. thus constituted a solid general introduction to the problems of farming.

The second year followed where the introduction courses left off by filling in the details. The curriculum continued to emphasize such general topics as farm layout, animal care and general farm management. The Science course concentrated on entomology, botany and analytical chemistry - all topics being related to everyday farm problems.[28] Veterinary Science focussed on the biology of cattle and the preparation of medicines to counteract any diseases the animals might contract. Meanwhile, English courses continued to stress grammar and composition and in the winter session of 1881, Shakespeare's *Macbeth* was studied,[29] followed in the spring by a selection of standards in literary taste. Mathematics became more complex; calculations relating to farm machinery such as pumps and hydraulic presses were instilled in students. The principles of surveying were also inculcated.[30] By the end of the two-year program a student would have a sound knowledge of agriculture's fundamentals and would be ready to use his newly acquired knowledge in solving practical farm problems. Ontario

Agricultural College graduates played a role in prairie agricultural education far beyond what could be generally expected of their numbers. W.R. Motherwell was one of these. In the 1880 term, Motherwell placed first in Easter examinations in chemistry and arithmetic and second in agriculture and veterinary anatomy. He was also first in general proficiency for 1880.[31] In his second year (1881), he placed first in English and mathematics, second in agriculture and natural sciences and fifth in veterinary science.[32] With this background it was natural that as Saskatchewan's Minister of Agriculture during 1905-6, he was responsible for setting up a multiplicity of programs in agricultural education.

Another prominent alumnus was W.J. Black who graduated in 1901. After securing his B.S.A. degree he was appointed editor of the western edition of the *Farmers' Advocate*, in 1905 Manitoba's Deputy Minister of Agriculture,[33] and in 1906 principal of the newly founded Manitoba Agricultural College.[34]

Yet a third, was W.J. Rutherford, graduating in 1903. He immediately accepted a position as Assistant Professor of Animal Husbandry at the Agricultural College of Ames, Ohio.[35] In 1906, however, he returned to Canada as Professor of Agriculture at the Manitoba Agricultural College.[36] When the Saskatchewan Agricultural College opened at Saskatoon in 1910, he accepted its Deanship.[37]

The last of the early O.A.C. graduates to play an important part in dry-belt agricultural education was John Bracken. A native of Seeley's Bay, Ontario, he was one of the brightest students ever to attend the college. Between 1902 and 1906 he finished first in his class for four consecutive years in the four-year Bachelor of Science in Agriculture programme.[38] A distinguished career as an administrator for the Saskatchewan Department of Agriculture, Professor at the Saskatchewan Agricultural College, Dean of the Manitoba Agricultural College, and Premier of Manitoba followed. His main contributions, however, were his two books - *Dry Farming in Western Canada* and *Crop Production in Western Canada*. Working in key positions in various educational institutions or in the political arena like W.R. Motherwell, W.J. Black and W.J. Rutherford before him, John Bracken also had considerable influence over the course of prairie agricultural education.

Manitoba's agricultural college was founded in 1905, Saskatchewan's in 1910 and Alberta's in 1913. Alberta actually established three smaller colleges at Claresholm, Olds and Vermilion rather than one larger college, to emphasize an outreach brand of agricultural education, while research agriculture was confined to the University of Alberta.

A more detailed examination of the Saskatchewan situation gives considerable insight into a curriculum that was for the most part repetitive of that throughout the Prairies. Saskatchewan's Agricultural College was established in 1910 as an integral part of the University of Saskatchewan in Saskatoon. According to Walter C. Murray, the university's President, the objective of the college was "to serve the people as a whole; it is not, therefore, to be an institution which exploits every novelty, which caters to every whim of the popular fancy."[39] The aim of the agricultural college was to bring about farm improvement. It was most important, in Murray's view, that the institution became an exponent of mixed farming.

> While it will not neglect the study of wheat and the most effective methods of tillage, it will in season and out of season proclaim the advantages of mixed farming. This province cannot afford to put all its eggs into one basket;

> nor can it afford to confine itself to an industry that occupies little more than half of each year.[40]

Next in importance was the conservation of soil moisture or dry-farming methods. A third objective, to bring agricultural developments to the attention of farmers unable to attend College, was behind the wide-ranging university extension programme.[41] What Murray had in mind was a practical programme designed to foment agricultural reform.

The Saskatchewan Agricultural College's curriculum was of three-years' duration. To secure entry to the college a student had to be 16 years old and of sufficient education to enable him to pursue his studies profitably. He also had to have spent at least two years immediately preceding entrance working on a farm.[42] Fees were relatively moderate. Tuition was pegged at $15 per year for Saskatchewan residents, while non-residents had to pay $30.[43] Room and board cost $5 per week.[44]

During the first year at the S.A.C., a student was provided with an introduction to agricultural theory and practice. Mandatory courses included field husbandry, agricultural engineering, animal husbandry, veterinary science, natural history, English and arithmetic.[45] The first course was taught by John Bracken. He lectured students on the principles of seed vitality, germination and growth, important crops, their history, and uses, and the origin, formation, and classification of soils.[46] The course of Agricultural Engineering constituted an introduction to the use of hand tools and a study of the care and management of farm implements.[47] Natural History dealt with plant life - an analysis of plant growth, the relation of weeds to crops, and identification of noxious weeds and seeds.[48] First-year courses then provided students with a basic knowledge of field husbandry.

In the second and third years students took slightly different course sequences. Listed on the cirriculum in the second year were 1) field husbandry, 2) agricultural engineering, 3) animal husbandry, 4) veterinary science, 5) dairy husbandry, 6) biology, 7) chemistry and 8) English.[49] In the third year horticulture and chemistry were deleted. Most interesting was the civics course in which students were introduced to farmers' political problems and their suggested remedies - public ownership, initiative, referendum and recall.[50] After graduating from the three-year course, a young farmer had probably the most complete background offered by any Canadian agricultural college.

The numbers of students enrolling in agricultural colleges were large. Saskatchewan led the way in fostering this trend by providing scholarships to students who demonstrated some signs of academic achievement. In 1908, the Saskatchewan Department of Agriculture offered a number of prizes to deserving students attending either the Manitoba Agricultural College or the Ontario Agricultural College. The most prestigious, valued at $200, was awarded "to the student from Saskatchewan standing highest among the students from Saskatchewan in general proficiency in the graduating class on completion of the regular two years' course."[51] The sum of $75 was provided "to the student from Saskatchewan in his class in general proficiency in his first year." Prizes of $50 were awarded to students taking first-class honours in either first or second year in agronomy, animal husbandry, dairying or horticulture. Every student successfully completing a two-

Figure 16. William Richard Motherwell, Saskatchewan Minister of Agriculture, 1906. (Saskatchewan Archives.)

Figure 17. Francis Hedley Auld, Saskatchewan Deputy Minister of Agriculture, ca. 1930. (Saskatchewan Archives.)

year course received $100.[52] With government assistance 8 Saskatchewan students enrolled at the Manitoba Agricultural College in 1906-7, 17 in 1907-8 and 21 students in 1908-9.[53] The O.A.C. also welcomed Saskatchewan students. Their numbers in attendance at Guelph totalled two in 1906-7, four in 1907-8 and six in 1908-9.[54] The years 1909-11 were witness to increasing numbers of Saskatchewan students attending agricultural colleges. In 1909-10, 51 future farmers were enrolled at the M.A.C., while in 1910-11 the figure rose to 55. The O.A.C. also experienced a slight increase in student enrollment to seven students in 1909-10.[55] With government assistance prairie students had begun to attend agricultural colleges in significant, though hardly overwhelming, numbers.

The Saskatchewan College's greatest impact was probably through its short courses. In 1914, 21 such courses were held in different parts of the province with a total attendance of 15,183. The largest crowds gathered in Saskatoon where 2460 individuals attended. At Maple Creek, 2000 persons were present, 1700 at Carlyle, 1450 at Milestone, 1980 at Alsask and 1460 at Paynton.[56] Programmes lasted either two or three days. Among the dry-farming topics discussed in the two-day curriculum given at Oxbow were principles of soil tillage, farm-implement efficiency, the draft horse, horse and tractor power, and cereal crops.[57] A three-day course was held at Carlyle from February 10-12. Discussed were such topics as the principles of soil tillage, farm-implement efficiency, the draft horse, horse and tractor power, dry farming in Saskatchewan, and forage crops in southeast Saskatchewan.[58] By 1918 the programme had been expanded to include 57 centres in rural Saskatchewan where lectures in field husbandry and farm accounting were delivered. Attendance was somewhat down from 1914 figures because of the war's demand for manpower, but the attendance at short courses still totalled 6796,[59] making the spread of dry-farming techniques inevitable.

A typical short course was the one held by the Saskatchewan College on the Saskatoon campus in 1918 with an enrollment of 75.[60] A week in duration, the course dealt with the production of crops such as wheat, oats, barley, rye, flax, bromegrass and potatoes. The lecturers were prominent dry-farming pioneers, including W.R. Motherwell, W.J. Rutherford, John Bracken, Seager Wheeler and F.H. Auld.

The first day was devoted to an introduction to field husbandry. John Bracken lectured on the nature and function of seeds, the soil and its relation to crop production, the causes and control of low yields, and the science and practice of tillage.[61] The second day dealt specifically with the problems of wheat growing, wheat varieties, soil management for wheat, and selection and breeding of wheat. Seager Wheeler then led a discussion on growing wheat for seed.[62] Oats and barley were the crops stressed the third day, and Bracken lectured on the importance of the oat crop in Saskatchewan, the culture of oats in Saskatchewan, a study of types and varieties and the culture of barley.[63] Rye, flax and peas had their virtues extolled the following day with W.R. Motherwell leading the discussion on the role of winter rye in Saskatchewan agriculture. Various lecturers touched on the difficulties of flax- and pea-growing techniques, and other related topics. On the fifth day lectures were provided on forage-crop production. Motherwell lectured on bromegrass and winter rye, while Bracken chose succulent winter feeds for Saskatchewan.[64] After such heady lectures and discussions on wheat, rye, flax and forage crops, the course's final session concluded with lectures on the lowly potato.

Agricultural colleges also provided short courses on the operation and maintenance of the internal combustion engine. The Saskatchewan Agricultural College offered instruction both on and off campus. In 1912 Joseph Dovey taught an extension course to farmers at Strassbourg, Abernethy, Nokomis, and Davidson, all railway towns. Meanwhile, on the Saskatchewan campus a ten-day course had been given in 1910. For $5 in tuition the students were taught how to properly handle gasoline-powered engines;[65] Tal Motherwell attended in this period before going to Guelph in 1912.

Agricultural societies in the prairie dry-belt continued to be active in conducting field experiments for provincial Departments of Agriculture. This was particularly true in Saskatchewan. Crops with potentially great value but beset with cultivation problems received the most attention. As before 1906 the Saskatchewan Department of Agriculture supplied interested farmers, recommended by their agricultural societies, with seed for winter wheat, clover, alfalfa and corn.

Winter wheat failed in Saskatchewan despite the interest the crop generated among grain growers. Among the enthusiasts for the newly introduced cereal were John Steuck and William Ballagh, Abernethy neighbours of W.R. Motherwell. Expressing interest in the experiments, they were forwarded sufficient seed to sow one acre.[66] They received specific instructions regarding technique:

> 1. The land should be free from weeds and in a good state of cultivation. The seed bed should be in a fine state of tilth but the soil should be firm.
> 2. Sow the seed at the rate of one bushel per acre. Sufficient seed is being sent you to sow one acre.
> 3. Sow one half of the seed about the last week in July, and the other half about three weeks later.
> 4. Care should be taken to prevent the fall growth being eaten off by horses, cattle, or other animals.
> 5. Cover one-half the plot with straw or strawy manure in the fall and note the effect when growth commences the next spring.
> 6. Cut as soon as ripe and exercise care in determining the weight of threshed grain.
> 7. Remember (1) date of sowing, (2) firmness of soil and (3) good supply of stored up moisture, are the most important factors in successful fall wheat growing in this province.[67]

But the experiment failed in two successive years when fluctuating warm and frosty spring weather killed the crop.[68]

Experiments with clover, alfalfa and corn also were less than successful. The 1907 bacteria culture prepared in Department of Agriculture laboratories in Regina for assisting in the cultivation of clover was found to be so unsatisfactory that its preparation was halted.[69] In 1908 there was a shortage of alfalfa soil necessary for innoculation and quantities had to be ordered from the Dominion Experimental Farm at Lethbridge.[70] Corn met an even worse fate. A.J. Colquhoun of Maple Creek reported to John Bracken that his crop froze.[71]

Agricultural society experiments, too often poorly organized, failed frequently but were useful for their educational value. Generally each agricultural society enlisted about seven or eight members to engage in experimental work. In 1908 the Carrot River Agricultural Society could claim five members growing winter wheat, alfalfa, red clover and corn.[72] Seven members of the Fairnede Agricultural Society raised controlled plots of winter wheat, corn, red clover, timothy, alfalfa and alsike,[73] while a year later 21 members of the Togo Agricultural Society made application to cultivate alfalfa, corn, rye, winter wheat, timothy and alsike.[74]

The total numbers of individuals conducting experiments for the Saskatchewan government are equally impressive, although statistics exist only for those planting clover in 1908. From locations as wide-apart as Lloydminster, Grenfell, Stoughton, Moose Jaw, Quill Lake, Maple Creek and Rosthern, 51 farmers spent time preparing experimental clover plots,[75] from which the professional field husbandmen could learn a great deal. After harvest each farmer was required to fill in a detailed questionnaire which he then forwarded to the Superintendent of Fairs and Exhibitions. The form dealing with clovers asked farmers to fill in the date of seeding, evenness of stand, weight in fall and date of cutting. Questions regarding the condition of the plot after a year's growth and the weight of the crop on a plot two yards square were also asked.[76]

For winter wheat the answers sought by the Department of Agriculture were considerably different. Experimenters were required to fill in blank spaces the variety, date of seeding, weight in fall, covering of snow, date of ripening, strength of straw, amount of rust, weight of grain and nature of soil. Other questions concerned the nature of previous cropping and cultivation and the appearance of the grain in the spring.[77] These questions posed by the Superintendent of Fairs and Exhibitions made the farmer more aware of the condition of his crop.

Alberta's experiments never reached the same proportions as those in Saskatchewan. In fact, they never really got off the ground, despite the urging of concerned farmers. In December 1912, the Taber Agricultural Society wanted to commence experiments along the same line as their sister province to the east. F.A. Sundal, the society's secretary, wrote Duncan Marshall, Alberta's Agriculture Minister:

> As there is a big field here for better Agricultural Education and a big opportunity for a little demonstration work, I should be pleased to hear from you if a plan could be worked out whereby the Provincial Government and the Taber Agricultural Society could work in conjunction, that is the expenses could be divided in some way, we to secure the use of a small plot of ground, say about twenty acres, divide the same into several small patches, and plant them into various varieties of tame grasses, forage crops, corn

> etc., and as our district now is developing more or less into mixed farming I am sure that a few experiments along these lines would be very beneficial to the country between Lethbridge and Medicine Hat who are working along the dry farming methods.[78]

A year later the society even went to the extent of issuing its own bulletins free of charge to every farmer in its district. But the society never did undertake any experimental work. In a curt reply to Sundal, Duncan Marshall declared it was beyond the Alberta government's financial capacity to engage in work of this type.[79]

On the other hand, Saskatchewan's agricultural societies co-operated with the provincial Department of Agriculture in bringing guest lecturers to all corners of Saskatchewan to speak on dry-farming techniques. To encourage grain growers to attend meetings, such leading agriculturalists as W.R. Motherwell, John Bracken and Angus MacKay were billed to speak. In 1907 the two star lecturers were MacKay and Bracken. In June of that year they were paired together to speak at Dundurn, Hanley, Bladsworth, Davidson, Craik and Lumsden, on topics of much interest to grain growers. MacKay and Bracken were well qualified to deal with soil cultivation, summer fallowing, features of successful grain growing and benefits of seed selection.[80]

The following year John Bracken took to the lecture circuit again - this time with John A. Mooney, President of the Canadian Seed Growers' Association.[81] Lecturing in Lloydminster, Marshall, Lashburn, Maidstone, Paynton, Haymont, Radisson, Borden and Langham, they covered such topics as the place of good seed in farm economy and how to produce it on the farm, soil cultivation - its object and importance to the grain grower, smut and its treatment, how to deal with the weed problem, features of successful grain growing and the work of the Agricultural Society.[82]

The key speaker in 1909 was W.R. Motherwell, Saskatchewan's Minister of Agriculture. Lecturing on diversified farming and the problems of the Saskatchewan farmer, Motherwell appeared in Humboldt, McGuire, Watson, Spalding, Englefeldt, Muenster, Burr and Guernsey. Less influential speakers also took to the road. Two of the better known of this group were J.H. Fraser of Qu'Appelle, Saskatchewan, and A.M. Campbell of Argyle, Manitoba. In a February 1909 tour through rural Saskatchewan, Fraser spoke on hints to the beginner, grain growing in Saskatchewan - some causes of failure - how to guard against them, and how to secure early maturity in wheat. Campbell's lectures complemented his colleague's; he dealt with soil cultivation - its relation to crop yields and to the weed nuisance, and defects of some common cultivation methods.[83]

Agricultural societies and the Saskatchewan government also catered to the new immigrants in their lecture services. In February 1908 John Bracken recruited P.M. Bredt, editor of the *Saskatchewan Courier*, a German periodical, to speak at Institute meetings at Vonda, Dana and Bruno in his native tongue. To encourage a good turnout the Department of Agriculture printed posters in German, to be distributed by local MLAs.[84] The following year the programme was expanded illustrating the degree of its success.

In fact, all of the Institute lectures were popular. In 1909, G.G. Pierce of Wadesa wrote John Bracken that "Mr. Frasers [sic] advise [sic] is worth a great deal to any new community where the farmers are not familiar with methods necessary for successful wheat growing."[85] Dr. F.P. Moreau of Howell, echoed similar sentiments, wishing only that Fraser had spoken in French because the majority of those in attendance were francophones.[86] It is quite likely that Motherwell, Bracken and MacKay were received in an equally favourable fashion and the lectures were carried on until the 1920s.

Alberta's agricultural societies also sponsored lecturers on farm topics. No one, however, held the status of the Saskatchewan trio of Angus MacKay, W.R. Motherwell or John Bracken as dry-farming innovators. For the greater part, the speakers who toured the Alberta circuit were junior Dominion Experimental Farm administrators. W.C. McKillican travelled through Alberta before succeeding S.A. Bedford as Superintendent of Brandon Experimental Farm. J.H. Grisdale lectured in Alberta before coming to Ottawa as Head of the Dominion Experimental Farm System. The only agriculturalist to lecture in Alberta at the height of his career was W.H. Fairfield, Superintendent of the Dominion Experimental Farm at Lethbridge. The majority of speakers at these agricultural gatherings were local farmers holding particular expertise in one area or another.

The agricultural, and particularly the seed, fairs were another popular means of advancing knowledge of dry-land farming. At various intervals, societies in Saskatchewan and Alberta would hold these events and provide prizes for the best seeds in each category. Organized properly, a seed fair would offer prizes for every type of produce that could possibly be grown on a farm. Such a fair was held at Trocher, Alberta, in the autumn of 1910. First and second prizes in the grains section were provided in the following categories: 1) bushel fall wheat 1909-10; 2) sheaf fall wheat; 3) bushel 6-rowed barley; 4) bushel sensation oats; 7) bushel Banner oats; 8) bushel oats any other variety; 9) sheaf of oats; 10) bushel of flax; 11) sheaf of spring wheat; 12) bushel Red Fyfe; 13) bushel Preston. Prizes were also available for vegetables. The meticulous gardener could win prizes for potatoes, turnips, carrots, beets, cauliflower, cabbage, corn, pumpkins, beans, peas, lettuce and rhubarb.[87] Prizes ranging from 25¢ to $1 for each item provided the incentive for prairie farmers.

Field competitions became an integral part of agricultural fairs. Farmers would enter fields of wheat, oats or potatoes or their entire farms into competition. Inspectors would examine the farm operations in minute detail and award prizes for deserving entries. Each category had criteria all its own. A field of Marquis wheat would be worth a maximum of 100 points. Points would be divided as follows: 10 for suitability of variety, 25 for freedom from weeds, 20 for freedom from other varieties, 15 for freedom from smut and hail, and 30 for apparent yield. For oats, the categories were somewhat different: 10 for suitability of variety, 10 for freedom from weeds, 30 for cultivation and freedom from other varieties, 10 for freedom from smut and blight, and 40 for yield. The key contest, "the Good Farms Competition," was also highly competitive. Out of a possible 100 points, a farmer could achieve 30 for the farmstead, 10 for machinery, 25 for live stock, and 35 for crops.[88] Monetary prizes as well as prestige in the community, served as an inspiration for prairie farmers to adopt efficient farm operations.

The ploughing match became an integral part of agricultural fairs after 1911. The objective of this competition was to encourage proper soil-tillage methods. In the prairie dry belt ploughing was particularly important. If soil moisture was not preserved or weed growth controlled, crop failures would result. Ploughing matches were seen as a means of educating many western farmers who were urban-bred:

> They are engaged in a new line of business, which, even under the best conditions, presents many problems not encountered elsewhere. If ploughing matches are worth while in the East, in the United States and in the Old Countries, then surely they are needed in the West, since the beneficial results derived from them, when well conducted, are so marked.[89]

To conduct a ploughing match it was suggested that the field be prepared for the competition by disc harrowing and packing in early spring. "This will keep the moisture near the surface and insure the plow drawing lighter and enable them [ploughmen] to do better work."[90] It was suggested by the Saskatchewan College of Agriculture that four categories be set up - walking ploughs, sulky ploughs, gang ploughs, and tractors, and that walking ploughs turn over 1-2 acres each, sulky 1 acre, and gang ploughs 1 1/2 acres. If tractors were entered, 2 1/2 acres could be suitable.[91] These acreages, of course, were variable. In real competitions such as the Elstow, Saskatchewan match, walking and sulky ploughs turned over 1/2 an acre apiece, gang ploughs 1 acre, and steam and gasoline tractors 4 acres.[92]

Competitors' work naturally required judgement. The Saskatchewan Agricultural College recommended a 100-point grading system -

Crown	15
Straightness	10
In and out of ends	10
Depth of furrow	7
Width of furrow	8
Finish	15
Evenness of top of land	15
Covering of Weeds	20
	100[93]

To make the competition worthwhile, prizes were offered for the best entries. Sums averaging $10 for a first-place finish, $5 for second and $3 for third were usually suggested for each category.[94]

Ploughing competitions rapidly increased after 1911 when 14 matches were held in Saskatchewan.[95] The number increased to 44 in 1914, 61 in 1915, and 62 in 1916. The numbers decreased to 50 in 1917, 47 in 1918 and 42 in 1919. But the reason was obvious - farmers were trying to produce as much grain as possible with limited manpower during the latter war years.[96] There was simply no time for competitions.

Tractor manufacturers began organizing customer short courses on internal combustion engine operation and maintenance as early as 1912. Courses were generally open to purchasers of machinery, their sons or employees, and salesmen marketing the product line. The three major companies involved in this endeavour were Rumely, International-Harvester and Hart-Parr. All three manufacturers held short courses at various prairie locations. Rumely offered two six-day courses at Calgary, Saskatoon, Regina and Winnipeg in February and March 1912.[97] During the same year International-Harvester held courses in Yorkton and Winnipeg.[98] In subsequent years Hart-Parr also offered courses at a number of unidentified locations.

Farmers flocked to these instruction programmes in large numbers. In 1912 in Calgary, 190 students enrolled in the Rumely course. The enrollment was broken down as follows:

> 62 were owners of gas engines; 47 were buying or going to buy some make of gas engine for spring delivery; 66 were attending for the purpose of learning to operate and hire out for the coming year and there was a small number attending for various reasons; some attending for two purposes, that is they might already own, and still be going to buy.[99]

The majority were, in the words of Gas Power Age, "a very enthusiastic young body of farmers, a credit to Alberta."[100] Students enrolled in the Rumely course at Regina in even greater numbers like the 486 men, who represented,

> the brawn and sinew of the coming mighty province of Saskatchewan faced the instructors, and if ever a moment of inspiration could be received it certainly was forthcoming in looking into the earnest faces of these students who early and late stayed around the engines fascinated with the mighty power of the coming age.[101]

In large classes the students received lectures on two and four cycle engines, valve and ignition timing, fuels and combustion, carburetors, elements of electricity, and elements of the magneto. The course also included talks on types of engines, multi-cylinder wiring, governors, lubrication, cooling, horsepower, power transmission, location of troubles, belt lacing, ploughs and hitches, shop methods and engine maintenance.[102] While each manufacturer related all discussion to his particular make of tractor, the courses served a useful function in teaching farmers the intricacies of their new machines.

The Correspondence School of Scientific Farming was established as a commercial venture to capitalize on the demand for dry-farming information. A Winnipeg concern, headed by E.C. Scythes, the school attempted to supply mail-order lectures and instructional pamphlets to prairie farmers. To encourage potential students to pay the $50 enrollment fee,[103] the school tried to provide lectures by well-known dry-farming pioneers. After failing to secure John Bracken, W.J. Rutherford and Angus MacKay because of opposition by F.H. Auld at Saskatchewan's Agricultural Extension Branch, the school employed only a slightly less distinguished group of agriculturalists. Heading the list was S.A. Bedford, former Superintendent of the Dominion Experimental

Farm at Brandon, of the Field Husbandry Department at the Manitoba Agricultural College. He was flanked by James Murray, another former Superintendent of the Brandon Experimental Farm; H.L. Bolley, a specialist in plant diseases, and Dean of the North Dakota Agricultural College; and W.H. Fairfield, Superintendent of the Experimental Farm at Lethbridge. Lesser figures were Thomas Shaw of the Ontario Agricultural College; R.E. Drennan, a relatively unknown specialist in animal husbandry; Archibald Mitchell, a junior agricultural administrator; C.H. Lee of the Manitoba Agricultural College; and Norman Ross, an employee at the Indian Head Experimental Farm.[104] The success of the venture is doubtful. Auld, who was also Saskatchewan's Director of Extension Work, considered the course to be overpriced. He felt that college extension programmes provided the same service for a fraction of the $50 enrollment fee.[105] Moreover, it is doubtful whether Saskatchewan farmers, the largest market for any course on agriculture, could be induced to part with their money without hearing the names Bracken, Rutherford, Wheeler or MacKay as instructors.

An organization unaffiliated with agricultural societies and agricultural colleges, yet influential in educating farmers, was the International Dry Farming Congress, a United States-based society. This body played a major role in educating farmers on the principles of dry farming because the Saskatchewan government in general and W.R. Motherwell in particular considered the group's propaganda to be valuable.

The peak years of success for the International Dry Farming Congress on the Prairies were 1909-12. In 1910 John F. Burns, Secretary-Treasurer of the Congress, wrote Dr. James Robertson of the O.A.C. that the previous year 50 representatives from Saskatchewan, Alberta, Manitoba and British Columbia attended the annual convention at Billings, Montana.[106] Canadian membership was represented on the executive with vice-presidents from each participating province.[107] A special train brought delegates from MacLeod, Lethbridge, and Carlstadt, Alberta, to the 1910 Congress at Spokane.[108] The delegates were treated to a variety of speakers including Canadians such as F.T. Griffin, C.P.R. Land Agent in Winnipeg lecturing on commercial results of dry-farming development in Canada and W.R. Motherwell, John Bracken, W.H. Fairfield, and George Harcourt, Alberta's Deputy Minister of Agriculture, speaking on unspecified topics.[109] Specialists in American agriculture such as J.H. Shepperd, Dean of Agriculture at the North Dakota Agricultural College, spoke on dry farm crop rotation, Dr. J.M. Hamilton, President of the Montana Agricultural College, lectured on the role of the agricultural college in the development of the West and H.M. Bainor of the Santa Fe Railroad spoke on the development of dry-farming implements - topics that could not fail to excite the Canadian dry-belt farmer.[110] The apex of Canadian participation came in 1912 when the Congress was held at Lethbridge, Alberta. With financial support from Saskatchewan's Department of Agriculture totalling $5000,[111] the election of W.R. Motherwell as President of the International Dry Farming Congress,[112] and 107 delegates from Saskatchewan - the largest convention delegation[113] - the congress was a major triumph for the Saskatchewan.

The succeeding years, however, were witness to a decline of Canadian interest in the Congress. Conference topics became less relevant, stressing agricultural problems in the American Southwest. Little attention was paid to the problems of early frost in dry-farming areas.[114] Consequently, Canadian interest began to wane. Nevertheless, as John Bracken concluded: "In earlier years the congress lent its energies to the gathering and distributing of information tending to show that crops could be grown in regions of low rainfall. This, its first mission, seems in a measure to have been fulfilled."[115]

Conclusions

With the arrival of the 1920s virtually all prairie farmers had become familiar with the concepts of dry farming. Agricultural colleges had been instrumental in teaching young farmers the latest scientific techniques. Extension courses made this knowledge available to farmers in the field, while agricultural societies also played a prominent part in disseminating the new knowledge. Co-operating with government, they participated in various experiments, thus providing farmers with first-hand knowledge of cultivation techniques for newly developed crops. They had sponsored agricultural institute meetings which gave farmers the opportunity to listen and question the leading experts on dry farming. Agricultural fairs served to improve seeding and ploughing methods. Manufacturers' courses in tractor operation and maintenance and proceedings of the International Dry Farming Congress disseminated yet more information to dry-belt farmers. The agricultural education explosion of 1906-20, made available to field husbandmen virtually anything they wished to know about farming.

EFFECTS OF DOMINION EXPERIMENTAL FARMS ON FARM IMPROVEMENT

An important role was played by Dominion Experimental Farms in developing cereal grains for dry-belt cultivation and in familiarizing farmers with dry-land agricultural techniques. William and Charles Saunders perfected Red Fyfe wheat and developed both Preston and the world-famous Marquis varieties. Farms at Brandon and Indian Head developed correct procedures for cultivating the new strains for summer fallowing and for seeding. They also tested such forage crops as bromegrass and alfalfa. Most important, the federal Department of Agriculture disseminated the information widely in pamphlets, books and individualized replies to the thousands of farmers who wrote letters seeking advice. At the same time an equally large number visited the stations in person.

Creation of Dry-Belt Experimental Stations

Pressure to establish an experimental farm system had existed throughout the latter half of the 19th century. Not only did the new immigrant need to learn about the problems of Canadian agriculture, but eastern Canadian farming methods themselves needed reform.[1]

Public demand for agricultural improvement surfaced in 1884 when a select committee of the House of Commons was appointed to investigate furture agricultural requirements. As its function the committee was authorized "to enquire into the best means of encouraging and developing agricultural industries in Canada and to report thereon to the House, with power to send for persons, papers, and records."[2] The committee sent a questionnaire to 1500 agriculturalists, farmers, teachers and businessmen, asking whether they considered the establishment of an experimental farm system to be desirable. An affirmative answer served as the government's encouragement.[3]

Intensive research was required to determine a suitable system for Canadian conditions. In November 1885 William Saunders was appointed to study the overall plans of American experimental farms and make proposals.[4] After extensive travelling throughout the United States, visiting farms in Iowa, Kansas, Wisconsin, Illinois, Ohio, Michigan and New Jersey, he filed his report.[5] The first part was devoted to descriptions of experimental stations and agricultural colleges but it contained no suggestions for applying American accomplishments to a Canadian setting.[6] The second part constituted the raison d'etre of the study: the proposals. According to the report the focal point of a Canadian set-up would be a Central Experimental

Farm located at Ottawa.[7] The Capital was not only suitable from a political and administrative standpoint but from an agricultural one as well.

> Here the climate represents the average condition of a large part of the settled portions of Canada where all the cereals and many other field crops can be successfully grown, and where most of the best varieties of grapes grown in the open air ripen well, and many sorts of apples and other fruits are raised with advantage.[8]

Sub-stations were recommended for the Atlantic provinces, Manitoba, the North-West Territories and British Columbia.[9] The central station would be the focal point of the system with its director, superintendents of agriculture, horticulture, and forestry, an entomologist, a botanist, a chemist and a veterinary surgeon.[10] The sub-stations would employ superintendents, subordinate only to the director in Ottawa. Farms would be geared to improving fruits, grains, dairy products, poultry and livestock.[11] Saunders' plan appeared workable and realistic.

On June 2, 1886 the Experimental Farm Stations Act received royal assent. Farms would be provided for the Atlantic provinces, Manitoba, the North-West Territories and British Columbia, respectively, with general direction from a central farm at Ottawa. The central farm near Ottawa was limited to 500 acres, Maritime and British Columbia farms 300 acres, and Manitoba and North-West Territories 640 acres.[12] Public opinion and the Saunders Report had proved instrumental and the government had acted swiftly.

Precise sites for experimental farms in Manitoba and the North-West Territories were not established by legislation. As a result a competition for farms in the Northwest emerged between various towns, individuals and government agencies. The competition was particularly fierce in Manitoba. At the forefront was the Department of Justice which proposed the North West Mounted Police Reserve at Shoal Lake. This acreage was particularly desirable because it contained a number of dwellings: one was a log house, 40 x 30 x 10 feet in size, another was the barracks 50 x 25 feet with a granary attached at the rear.[13] The property's main attraction, however, was that it was already owned by the federal government, but the unsuitability of the land for agriculture posed a disadvantage.

Another site suggested was a farm near Morris. One mile from the town site and the Red River, and accessible by rail, this property was prime Red River valley farmland.[14] A possible disadvantage for testing purposes was the greater rainfall and superior soil. In any case, both sites were passed over in favour of Brandon because of local pressure placed on the federal government. In January 1887 J.G. Hughes, Acting Mayor of Brandon, wrote John Carling, the federal Agriculture Minister, requesting that the farm be situated there. He stated that city council intended to draft a petition "setting before you the wishes of our people regarding the establishment of an Experimental farm in this vicinity."[15] Brandon's Board of Trade soon took up the fight. On 4 April 1887 J.C. Robinson, President, and Charles A. Larkin, Secretary, forwarded a petition to John Carling recommending the farm's establishment. Brandon's assets lay in the availability of land, presence of a typical prairie soil, and access to financial and retail services.[16] Evidently the federal government agreed with Brandon's City Council and Board of Trade.

The Indian Head site for the North-West Territory's experimental farm was selected without as much lobbying. For one thing, Indian Head was a natural choice. The Indian Head District and the nearby Qu'Appelle Valley were the first areas to be farmed in the District of Assiniboia. Moreover, precipitation in the area was limited; the farm would serve as a testing ground for dry-land farming. Given the government's interest in opening up new dry-belt areas for cultivation, it was little wonder that the government responded favourably when F.W. Stobart offered the federal government the Bell bonanza farm, along the C.P.R. main line, even for $12 per acre.[17]

The federal government spent considerable sums on both farms to ensure success. In 1887-88, $12,000 was allotted to Brandon and Indian Head for buildings, furniture and fencing, and $6000 for agricultural equipment. Contingencies constituted another category. In 1887-88, $1000 was allotted to both experimental stations as an emergency fund. One of the main operational expenses was the need to pay employees. In 1887-88 Superintendents of Brandon and Indian Head Farms received $1200 for 12 months' work.[18] Both farms received $1000 each for temporary help and $800 for stationary, and by 1890, both farms were operational.

Contributions of Angus MacKay and Charles and William Saunders

Three key figures in the Dominion Experimental Farm system were Angus MacKay, Superintendent of the Indian Head Experimental Farm, William Saunders, Director of Dominion Experimental Farms, and Charles Saunders, Dominion Cerealist. MacKay was one of the discoverers of summer fallowing, William Saunders a perfecter of Red Fyfe, Preston and Huron wheats, and Charles Saunders the discoverer of Marquis wheat. These men, more than any others, made wheat the paramount prairie crop.

Angus MacKay was born in Pickering township, Ontario County, Ontario, on January 10, 1841 and educated at the Old Whitby Grammer School. Little is known of his life before 1882 except that he served as a lieutenant in the 34th regiment at Fort Erie during the Fenian raids. In 1882, at the age of 41, he trekked west from Winnipeg with three companions to begin farming operations at Indian Head.[19] For several years he farmed at that location, discovering the value of summer fallowing as a means of preserving soil moisture. MacKay returned east in 1887 to work at the Central Experimental Farm. In 1888 he was appointed Superintendent at the experimental farm at Indian Head. Here he remained at the forefront in dry-land agriculture. He tested various grains perfected at the Central Farm under prairie conditions. He wrote extensively in agricultural journals on suitable dry-land ploughing methods. His correspondence with prairie farmers was voluminous,[20] and he was always eager to provide farmers with tours of the research facility.

Born in Devonshire, England, in 1838, William Saunders emigrated to Canada as a child. After growing up in London, Ontario, he began a career as a manufacturing chemist, operating a successful business in London during 1860-85. Saunders held more than pure business interests. He was concerned with every aspect of science. He became a founder of the Ontario College of Pharmacy and served as the college's president for two years.[21] But his real interest lay in agriculture. Experimenting with various fruits in his city garden and on a rural plot he owned, Saunders soon became a renowned horiticulturalist. He served as president of the Ontario Entomological Society from 1883 to 1886, a society he helped found. In 1882-85 the Ontario Fruit Growers' Association awarded him the society's highest office. The Marquis of Lorne nominated Saunders as the first Fellow of the Royal Society of Canada in 1881. Laden with laurels, Saunders was appointed Director of Experimental Farms in 1886.[22]

As the first Director of Dominion Experimental Farms, Saunders was responsible for the report that led to their establishment, and for hiring the personnel to man the system. Saunders' research was oriented in several directions, but his main love was horticulture - a love he continued to pursue even after his promotion. He established an arboretum and introduced hardy shrubs and trees from all parts of the world.[23] He was particularly assiduous in the perfecting of roses and hardy fruit and berry varieties. Prince and Pioneer crab apples, derived from Liberian species, became widely planted on the Prairies, as did his hardy strains of black currants, red currants, raspberries and gooseberries.[24] His main accomplishment, however, lay in his work with cereal grains.

Saunders' discoveries include Huron and Preston wheats. The main variety grown in eastern Canada for 30 years after its discovery, Huron was considered one of the best spring wheats. Preston, a cross between Red Fyfe and Ladoga, proved profitable in eastern Canada, and even supplemented Red Fyfe on the Prairies.[25] These crosses provided the background for the discovery of Marquis wheat.

The younger Saunders was born in London, Ontario, in 1867 and was educated at the University of Toronto where he received an Honours Degree in Science in 1888, and Johns Hopkins University where he completed his doctorate in chemistry. For a number of years Saunders was a professor of chemistry and geology at the Central University, Kentucky. In 1895 he resigned to begin a short but unsuccessful stint as a Toronto musician and music teacher. His father secured his appointment as Dominion Cerealist in 1903, a position Saunders was to hold until 1922.[26] In these years, Saunders was to leave a firm imprint on the development of both prairie and world agriculture.

Marquis was discovered in 1904. The strain was developed from one particularly favourable cross between Red Fyfe and Hard Red Calcutta, an early ripening Indian wheat.[27] A Reginald Buller notes:

> that Hard Red Calcutta is a trade expression, not for one particular variety of wheat but for a mixture of several varieties. There must, therefore, always be a certain amount of doubt as to the exact type which served as the female parent when the cross was made. The result of the cross, in a few generations, was a mixture of types

> including Marquis. Marquis, therefore, remained mixed with other sorts of wheat until it was discovered in 1904 by Dr. Saunders, in the course of his systematic work of re-selection of all the mixed wheat which previously had been produced by cross-breeding at Ottawa.[28]

Saunders wrote of his discovery that:

> the cross was made on one of the branch experimental farms and the cross-bred seeds, or their progeny, were subsequently transferred to Ottawa. Here some selection was done, but the work was not carried far enough to separate out simple fixed types. It was therefore a mixture, lacking in uniformity, which came into the possession of the writer when he took charge of the Cereal Division. By a careful study of individual plants selected from the plot, and especially by applying the chewing test to ascertain the gluten strength and probably breadmaking value, radical differences in quality were found, and a few of the most promising plants were used as a foundation of the new strains. These strains were propagated (each separately) for some years until they had been sufficiently studied to ascertain which was the best. The best strain was named Marquis.[29]

Marquis proved to be a major discovery because it ripened six days earlier and yielded 400-800 pounds more seed per acre than Red Fyfe.[30] It swiftly became the principal prairie grain after 1910, serving as Canada's food contribution to the war effort, and continuing as an important cash crop during renewed 1920s prosperity.

The impact of Saunders' discovery was not only felt on the Canadian Prairies but throughout North America as a whole. After 1909, when Marquis was first seeded extensively,[31] the variety's use spread to the United States. In Minnesota 46 per cent of all wheat lands in 1917 were seeded with Marquis. The results were similar in other states: 34 per cent of North Dakota's wheat crop, 43 per cent of South Dakota's, and 45 per cent of Montana's were devoted to Saunders' discovery. Marquis had evidently proven superior to Preston, Blue Stem, Durum and Red Fyfe in these areas.[32]

Experimental Tests at Brandon, Indian Head and Lethbridge

Dominion Experimental Farms at Brandon, Indian Head, and Lethbridge, conducted a great many experiments related to dry farming. Techniques for the cultivation of Red Fyfe and Marquis wheats were perfected, summer-fallowing methods were tested, and comparisons were made between broadcasts and drill seeding. Smut prevention using bluestone was also refined. The farms did not confine themselves to the primary cereal grains. Bromegrass and alfalfa were grown and the results were analyzed. Controversial advances such as soil-packer usage were tested and the results published. In short Brandon and Indian Head Experimental Farms were at the forefront in advancing dry-farming methods.

Tests at Brandon and Indian Head confirmed the superiority of Red Fyfe over other wheats in 1890-92 and Marquis over its competitors in 1912. In 1890 Red Fyfe was sown in a one-acre plot at Indian Head, against other varieties such as White Fyfe, Ladoga and several lesser-known types. Red Fyfe was easily the most productive. Although later maturing than its competitors, it yielded 28 bushels, 20 pounds per acre and weighed in at 64 pounds per bushel compared with 20 bushels, 49 pounds per acre and 64 1/2 pounds per bushel for White Fyfe and 21 bushels, 30 pounds per acre and 64 1/2 pounds per bushel for Ladoga.[33] Results at Brandon in 1892 were similar, only the competitors were different. On one-fifth of an acre summer-fallow plots, Red Fyfe easily outdistanced Old Red River, Pringle's Champlain, Campbell's White Chaff, Chilian White and Wellman's Fyfe.[34]

It was only in 1912 that Red Fyfe was challenged. The new wheat was of course Marquis. Seeded over a four-year period Marquis matured in 125 days and yielded 39 bushels, 25 pounds per acre. The old standby, Red Fyfe, took 134 days to ripen and produced only 31 bushels, 22 pounds. Two other popular strains, Preston and Huron, matured as early as Marquis, but their yields were significantly lower.[35] Similar results were duplicated at Brandon. There Marquis produced a whopping average of 45 bushels, 3 pounds per acre and ripened in 107 days. Only Preston could come close; Huron and Red Fyfe were well down the list.[36]

Dominion Experimental Farms also took steps to assess the utility of summer fallowing on the prairie dry belt and as early as 1890 the farm at Brandon used oats in experiments. Two fields of Black Tartarian oats were seeded - one on fallow, the other on wheat stubble.[37] Both crops were sown and later cut at the same date. The fallow yielded 49 1/2 bushels per acre with a weight of 34 1/2 pounds per bushel. The wheat stubble field produced only 30 bushels per acre with a weight of 39 pounds per bushel.[38]

Experimental farms were interested in determining the advantages of drill versus broadcast seeding in relation to crop yields. Therefore, a series of tests were conducted using both devices under carefully controlled conditions at Indian Head in 1890. Fields of Red Fyfe wheat were seeded by drill and broadcast on the same day. Both fields were harvested at a similar date. The seed-drill produced a slight advantage: 35.16 bushels, 59 pounds versus 32 bushels, 59 pounds.[39] In subsequent tests at Indian Head and Brandon the results were more pronounced. An experiment at Brandon, comparing the press drill versus the broadcast machine, resulted in the following statistics for wheat: press-drill 28 bushels, 50 pounds per acre; broadcast machine 22 bushels, 10 pounds per acre.[40]

Experiments in 1894 conclusively proved the superiority of the press drill. Experiments at Brandon demonstrated that by seeding 3 1/2 inches down, the press drill would produce 12 bushels per acre more wheat then the broadcast machine.[41] Similar Indian Head experiments gave the press drill a 13-bushel-per-acre advantage over its competitor.[42] S.A. Bedford, Superintendent of Brandon Experimental Farm, summed up the situation for Manitoba when he stated:

> In addition to a report of this year's tests of drilling and broadcasting wheat, a summary of four years' tests is

> also given; it will be seen that the average difference in favour of drills is over 5 bush. per acre with wheat, and 11 bush. with barley. It is estimated that there are one million acres devoted to wheat in this province, and if only 25 per cent of this is sown broadcast and the results reached on this farm fairly represent the whole province it represents a loss of over one million bushels a year.[43]

The evidence thus gathered by the experimental farms was given full credence and the drill press quickly became popular. Yet there was some concern about the appropriate depth for optimum sowing results. The most telling experiments were conducted at Indian Head on Red Fyfe in the 1890s and it was assumed that once a suitable depth for seeding was established it could generally be used for all other varieties. Tests began in 1892 and concluded four years later. One-tenth of an acre plots were sown one inch, two inches and three inches deep. All plots were seeded and harvested at similar times each year, the specific dates being determined by local weather conditions. Sown one inch deep, Red Fyfe did not fare too well. In 1892-95 the seed was swept away by prairie winds.[44] Sown three inches the seed yielded anywhere between 18 and 38 bushels per acre. But these figures were not outstanding when compared with grains seeded at two inches. The latter produced 15-45 bushels and averaged approximately 3 bushels more per acre over wheat planted three inches deep.[45] In short, the experiments had concluded that contrary to the Brandon testing of 1894, sowing at a medium depth would more likely produce a superior crop than shallow or deep seeding.

After solving the logistics of proper sowing procedures, the experimental farms turned their attention to the sowage of grain diseases, concentrating specifically on smut which wreaked the greatest havoc. When bluestone treatment became available they quickly tested it at Indian Head in 1898. The experiment utilized four test samples of bluestoned and unbluestoned clean and smutty Red Fyfe seed. "Bluestone was dissolved in water, in the proportion of one pound to two pailsful. In this solution the seed was dipped. The smutty seed used was quite black and totally unfit for any purpose whatever."[46] The clean Red Fyfe treated with the solution received one pound for every ten bushels; one pound for every eight bushels was applied to smutty seed. The seed was then planted. Results demonstrated the superiority of the treatment. On every 25 square feet, untreated clean seed produced 244 smutty and 1014 good heads. On untreated smut-infested seed there were 643 infected heads and 741 satisfactory ones. The clean bluestoned seed was remarkably pure, producing no smutty heads and 1342 satisfactory ones. Even the badly smutted bluestoned seed produced a good crop of 1110 healthy heads to 21 smutty ones.[47] The results were watched with interest, and when proven successful, rapidly adopted by the prairie farmer.

The Indian Head and Brandon farms also began to experiment with a variety of fodder crops, for example, bromegrass and alfalfa, to preserve and enrich soil fertility. Even before 1897, the farm at Brandon had been cultivating bromegrass. Superintendent Bedford was enthusiastic about the crop possibilities:

> As a pasture grass for this province it is perhaps unequalled, standing easily in the spring it is fit to pasture two weeks earlier than our native grasses, thus admitting of cattle being turned on it much sooner; the aftermath late in the summer is also heavy. This year the Experimental Farm cattle were pasturing on it up to the first of November and when snow came it was still several inches high and quite green; there is no question that this grass will materially assist in keeping up a flow of milk in the autumn months when native pastures are dried up.[48]

The crop was so attractive that drawbacks such as difficulty in its control were downplayed:

> Owing to the many branching roots of this plant some anxiety has been expressed regarding the danger of its spreading and becoming a weed, in the six years it has been growing on this farm, none of the plants have spread and on a plot thinned, immediately after laying and back-set this fall, it was found that the sod was well rotted, and all the plants killed.[49]

Bedford was obviously somewhat sanguine in his forecast for bromegrass, but this was only a prelude to the euphoric discussion of alfalfa's qualities.

Positive results in alfalfa growing at Brandon inspired Bedford's successor, James Murray, to write glowingly of the crop. He asserted that although alfalfa had not been a success at Brandon at the turn of the century, by 1912 it was yielding excellent harvests. He suggested that every farmer try it. "If the excellent qualities of the plant as a forage crop were known, with the conditions necessary to its successful cultivation, it would undoubtedly be grown much more extensively."[50] Results from experiments had been encouraging. Grimm's alfalfa sown in 1907-8 yielded 2200 pounds per acre of hay in 1910.[51] These figures presented a vast improvement over earlier experiments at Indian Head. Angus MacKay could only report a yield of 600 pounds from Turkestan seeded in 1904.[52] Murray, unfortunately, did not estimate the costs of producing alfalfa, nor did he take into careful account potential difficulties farmers might encounter. Like his predecessor, Murray was susceptible to "boosterism," a prairie disease that struck the many who thought that they had the solution to all the prairie problems.

Like the seed-drill tests the experimental farms tested other controversial equipment, such as the soil packer. Experiments with this device were first conducted at the Experimental Farm in Lacome, Alberta. In 1909 the surface soil packer was tried with wheat, oats and barley, the packer following the drill. This land was ploughed out of sod in 1909, packed, disced and thoroughly worked. The cultivation given the plots was exactly the same, except for the use of the packer after the grain was sown.[53] G.H. Hutton, Superintendent of the Lacombe farm, waxed enthusiastically over the experiments' results.

> The large proportion of the land in Central Alberta is rich in humus and, when freshly turned by the plough, lies loosely with numerous relatively large spaces. The packer closes the majority of these air spaces by compressing the

> soil, thus preventing the too free circulation of air which would carry away with it large quantities of moisture...The advantage of the use of the packer after the grain drill lies in the fact that the seed and the soil are brought into close contact, that the moisture promptly rises to the seed, that germination is more uniform and rapid, and that the young rootlets readily establish themselves in the firm soil.
>
> ...If the use of the soil packer will increase the yields on this area by five bushels per acre (which judging by results here, is a moderate estimate) the increased money return to the farmers of the province who do not pack their land, valuing wheat at 80 cents per bushel, barley at 40 cents and oats at 25 cents per bushel would be $2,492,867.[54]

Experiments at Brandon and Indian Head provided evidence to back Hutton's conclusions. In 1913 unpacked wheat yielded 45 bushels, 25 pounds per acre while the soil packer, surface or sub-surface, increased the harvest a minimum of 5 bushels and a maximum of 10 bushels for each acre seeded.[55] At Indian Head in 1915, packers of various types upped yields by 13 bushels per acre.[56] In short, the packer had proven to be a useful addition to dry-land farming machinery rather than just another gimmick.

Role of the Central Experimental Farm in Ottawa

The Central Experimental Farm in Ottawa was at the forefront of propagandizing the techniques developed on the prairie. Much of the correspondence consisted of personal replies to various farmers' queries from Charles Saunders, the Dominion Cerealist. Pamphlets dealing with wheat selection, ploughing methods and plant disease control were made available for general use. These tracts were written by such authorities as William and Charles Saunders, and Angus MacKay. To a lesser extent, the farms in the Prairie provinces engaged in the same activity by encouraging groups of farmers to visit their facilities.

Prairie farmers constantly sought to cultivate the ideal wheat. A number of them seeded such undistinguished varieties as Club, Riga, and Kubanka, on an experimental basis. Concerned with the quality as well as the quantity of their harvest, they wrote Charles E. Saunders, Dominion Cerealist, asking for suggestions. Saunders' replies were succinct, detailed and helpful. Club Wheat, which was grown by W.H. Small, and George Dow of Gilbert Plains and J.B. Parker of Umatilla, Manitoba, had definite drawbacks. After being forwarded samples of this variety by these enthusiastic farmers, Charles Saunders arrived at some very definite conclusions:

> The sample of "Club Wheat" is also received. It is very good in appearance, but would not in my opinion, make as good flour as the Preston, and is somewhat deficient in gluten strength. It is scarcely possible to assign such

> wheat to any ordinary grades as they are based on Red Fife, and this "Club" wheat is so different in character. It is not a variety that would be favourable received by millers.[57]

A month later Saunders was even more specific. He advised J.B. Parker that Club's gluten strength was inferior to Red Fyfe's.[58] He dealt the death blow by declaring that it was "unwise to grow this wheat for any other than strictly local use. If it were exported it might injure the reputation of all the wheat grown in that area."

A similar fate befell Riga and Kubanka. A variety that the experimental farms did not care to recommend despite its early ripening, Riga suffered from low yields.[59] Kubanka's drawback was that it produced yellowish bread,[60] an unforgiveable quality in the eyes of any miller.

Actually, in the early years of the Experimental Farm system, William Saunders saw Lagoda as the ideal prairie wheat.[61] Its most promising characteristic was early ripening. Moreover, the quality and quantity of the yield was seen as promising after two years.[62] Saunders strongly recommended cultivation of the Russian variety because:

> Ladoga is a productive and valuable variety of land wheat, which has thus far ripened over the whole Dominion ten days earlier on the average than the Red Fife. That the better samples obtained are fully as rich in gluten as the best Red Fife, and while the cultivation of the Red Fife should be recommended in every section of the North-West, where it is likely, with early sowing, to escape the autumn frosts, the growth of Ladoga may be safely encouraged wherever the ripening of the Red Fife is uncertain, without incurring the risk of materially lowering the reputation or the general quality of Canadian hard wheats.[63]

Three years later Saunders was forced to reverse his stance. Ladoga had proven a failure because its flour quality was inferior to Red Fyfe's. Moreover, bread baked from Ladoga also had the yellowish tint.[64] Red Fyfe was to remain supreme in the eyes of leading agriculturalists in the Dominion Experimental Farm system. It was only in 1915, after Charles Saunders had produced the Marquis hybrid[65] which had then undergone eight years of meticulous testing, that Red Fyfe was replaced as the most productive prairie variety.[66]

Dominion Experimental Farms published bulletins to instruct field husbandmen on proper grain-growing techniques. In 1895 William Saunders published a pamphlet entitled, "Results of Experiments with Early, Medium and Late Sowings of Grain,"[67] in which it was conclusively proven that wheat and oats should be seeded as early as possible. Another pamphlet discussed land preparation techniques. J.H. Grisdale wrote about suitable methods for breaking and backsetting, summer fallowing, and ploughing, with sections devoted to each prairie region.[68] Suggestions like these, proffered by leading agriculturalists, went a long way to improve general cultivation in the Prairies and other parts of Canada.

Department of Agriculture bulletins also focussed on plant diseases. As soon as bluestone treatment became available, Dominion

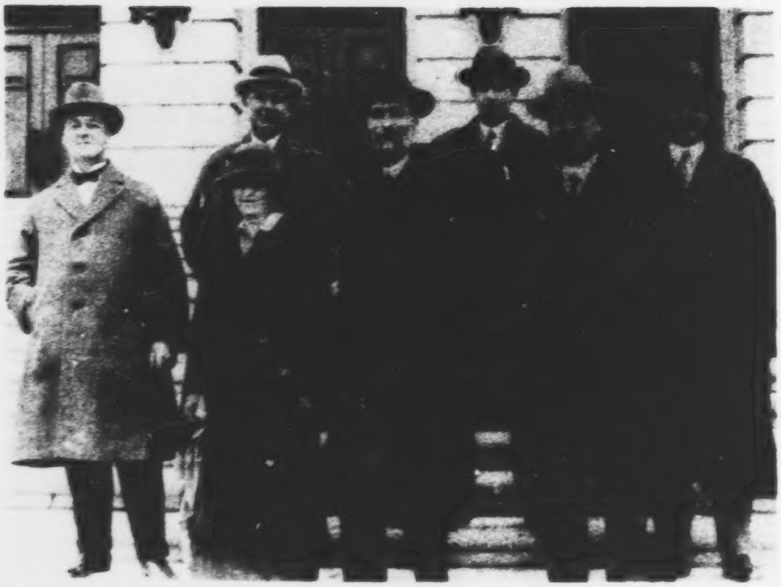

Figure 18. Dr. Charles E. Saunders of Ottawa, discoverer of Marquis wheat, and Mrs. Saunders (*centre*) with (*left to right*) Mr. J.C. Mitchell of Dahinda, Saskatchewan, three times winner of the World's Best Wheat Prize; Professor Manley Champlin, of the Field Husbandry Department of the University of Saskatchewan; Mr. M.P. Tullis, Field Crops Commissioner, Department of Agriculture; Mr. F. Hedley Auld, Deputy Minister of Agriculture; and Mr. James S. Field of Regina, winner of the World's Best Wheat Prize in 1920. Regina, 1925. (Saskatchewan Archives.)

Experimental Farms began to recommend its usage. In 1888 the first bulletin on smut appeared. Its author, James Fletcher, entered into a discussion of types, stages, and effects of smut upon cereal grains. Quoting S.A. Bedford, then a farmer at Moosomin, N.W.T., he suggested applying 1 pound of copper sulphate in a pailful of hot water to be sprinkled on every 10 bushels of wheat.[69] Years later smut prevention measures had been radically improved. In a bulletin published by the Seed Branch of the Department of Agriculture, E.H. Faull provided detailed statistical charts for duration and strength of various crops.[70] Specifics were given for the drying period before seeding, information that was not normally available, and such close attention to detail enabled farmers to cultivate healthy grain crops.

The regional experimental farms supplemented these educational processes by encouraging visits to their research facilities. In 1911, 1579 people from Swift Current, Estevan, Saskatoon and a host of smaller centres boarded a special excursion train to Indian Head.[71] The trip was a joint venture of the Saskatchewan College of Agriculture and the Indian Head Farm. The college arranged trains and advertising while

Figure 19. Field Day (?) at Experimental Farm, Indian Head, ca. 1913. (Saskatchewan Archives.)

the federal government provided farm tours.[72] Similar plans were made for an excursion to Rosthern during the same year. At that experimental station the local superintendent, along with John Bracken and F.H. Auld, were present to comment on active experiments.[73] Nine years later the excursions were still exciting ventures.[74]

The Experimental Farm system had a profound impact on the success of dry-land farming techniques. Among its successes should be included the development of suitable wheat varieties, the perfection of summer fallowing, and the discovery of proper sowing and cultivating techniques for dry-land grain growing. Moreover, the system had publicized its findings well. By corresponding with the Dominion Cerealist, obtaining Department of Agriculture pamphlets or visiting an experimental farm, the field husbandman could easily become aware of the latest dry-farming methods.

W.R. MOTHERWELL'S CONTRIBUTION TO DRY FARMING

More than any other individual, William Richard Motherwell personified all that could be accomplished in developing and disseminating dry-farming technology. An early graduate of the Ontario Agricultural College, he pioneered in summer fallowing during the 1880s. Early in his farming career he experimented with or acquired a knowledge of crops such as bromegrass, alfalfa, flax and rye and as Saskatchewan's Minister of Agriculture in 1905-18, he wrote about his findings and lectured widely. Among his achievements can be included the popularization of dry-farming methods by encouraging visits to Dominion Experimental Farms, participation as a leading figure in the International Dry Farming Congress, and personal exhortations to prairie farmers to adopt suitable agricultural procedures.

Motherwell's Early Training at the Ontario Agricultural College

Motherwell's educational background at the O.A.C. served him well. The subjects he studied and mastered were both practical and relevant. Even before setting foot in the North-West Territories he had a rudimentary understanding of summer fallowing and crop rotation.

During his two years of study at Guelph, Motherwell excelled in four areas: agriculture, science, English, and mathematics. By far the most important was the first. Placing second in his class in both first and second years, he was exposed to summer fallowing and crop rotation patterns, farm layout principles, tree planting and maintenance.[1] Within a few years after graduating he practised summer fallowing on his Abernethy homestead. Likewise, the arboriculture segment also proved useful and by 1910 his farm was bordered with hundreds of shade trees and shelterbelts.

Motherwell's knowledge of the remaining agricultural subjects was put to more limited use. Placing first in science in 1880, second in 1881, and first in mathematics in both years,[2] Motherwell later took hardly an interest in these areas. As Saskatchewan's Minister of Agriculture he never concerned himself directly with such topics as insect control, perferring to leave these problems to his Departmental experts.

Motherwell's Advice to Grain Growers

One of Motherwell's main interests lay in proper crop-cultivation techniques. On this and related topics, he was both an experimenter and prolific writer. Having accumulated a detailed knowledge of the specifics of wheat growing, he was always willing to provide farmers with the information he had amassed. Motherwell experimented with bromegrass and acquired a knowledge of alfalfa, flax and rye. He was at the forefront in communicating with leading agriculturalists and disseminating the latest findings to all interested individuals.

Wheat-cultivation techniques absorbed much of Motherwell's time. His most complete assessment of wheat-growing technology was provided in a Department of Agriculture bulletin entitled, "Methods of Soil Cultivation Underlying Successful Grain Growing in the Province of Saskatchewan." Consisting of revised reports of two lectures delivered at the International Dry Farming Congress in 1909 in Billings, Montana, and the following year in Spokane, Washington, the pamphlet provided a definition of dry farming and instructions on proper soil-cultivation practices.[3]

Motherwell defined dry farming as a system of agriculture incorporating the use of the summer fallow to preserve soil moisture.[4] Unlike summer fallowing in eastern Canada where:

> the usual custom was to let the intended fallow lie idle until the first of July, at which time the weeds were waving in the wind and sometimes half way up the horses sides...this system, which neither encouraged the extermination of weed seeds nor conserved moisture, but rather dissipated it, was soon abandoned in favour of the more enlightened methods of early ploughing, immediately after seeding, and frequent subsequent tillage, nor only for the purpose of killing weeds, but also in keeping the soil in a proper condition to receive and retain the rainfall.[5]

Motherwell's ideal system of summer fallowing consisted of the following: 1) shallow tillage in the autumn to enable the soil to receive melting spring snows and to germinate weed seeds early; 2) early spring ploughing of the fallow; 3) harrowing and packing after ploughing.[6] Summer fallowing "at intervals of every third year, or thereabout," deep ploughing, medium-depth sowing, and thin seeding were recommended.[7] These techniques, Saskatchewan's Agriculture Commissioner assured his readers, would virtually guarantee a good grain crop.

Farm Crops published a summary of Motherwell's view on wheat cultivation in 1909 in which his approach to soil-moisture preservation by means of summer fallowing was stressed.[8] He also added suggestions for seed selection, seed drilling and weed control. Seed selection was important because plump, healthy grain would obviously produce better crops than thin and sickly appearing kernels. Drilling two to three inches prevented prairie winds from mercilessly denuding fields from their valuable grain seed. Proper weed control enabled plants to obtain the best possible soil nourishment instead of having unwanted seedlings competing for the soil's resources.[9]

To ensure that his dry-farming suggestions were read and understood by all Saskatchewan farmers, Motherwell designed a short, humorous bulletin entitled, "Ten Dry Farming Commandments." Published by the Department of Agriculture, it propounded the following advice:

1. Thou shalt have no other occupation than farming.
2. Thou shalt fallow thy land every third year, being careful to plough it both early and deeply.
3. Thou shalt cultivate thy fallow and not allow weeds or any other thing that is green grow thereon, or winds to blow through it, for in such was the moisture which thy fallow should conserve will be wasted and thy days will be nothing but labour and sorrow.
4. Thou shalt not despise the harrow, but shalt use it even whilst thou ploughest, and shalt place thy chief reliance upon it thereafter, whether in early spring, late spring, midsummer or autumn.
5. Thou shalt sow good seed early and down into the moisture, lest peradventure it cometh not up betimes. He who soweth his seed in dry soil casteth away many changes of reaping.
6. Thou shalt not overload thy dry land farm with seed, even as the merciful man doth not overload his ox or his ass. Thin seeding best withstandeth the ravages of drought and hot winds.
7. Thou shalt keep on thy dry farm such kinds and numbers of horses, cattle, sheep, pigs and poultry as the water supply maketh possible, and thou canst grow pasture, fodder, roots and grain for. Thus shalt thou be protected against adversity, and thus shalt thou give thy children and children's children cause to call the blessed, inasmuch as thou didst not too greatly dissipate in thy lifetime the fertility stored in thy soil through many thousands of years.
8. Thou shalt not live unto self alone, but shalt join the Grain Growers' Association, the agricultural society in thy district or any like minded organization that is good. Through these thou shalt work unceasingly for the welfare of thy district and the upbuilding of Saskatchewan agriculture.
9. Thou shalt study thy dry land farm and its problems unceasingly, and ponder on ways and means whereby its fruitfulness may be increased keeping always in memory the fact that not alone by speeches and resolutions, but also by intelligent and timely hard work shall production be increased and the economic salvation of thy country be wrought.
10. Thou shalt not covet thy neighbour's big farm, nor his mortgage, nor his worry, nor his hurry, nor anything that is thy big neighbour's.
    Remember these dry farming commandments to keep them wholly.[10]

These suggestions made it clear what Motherwell thought were the ingredients for successful grain growing.

Motherwell willingly rendered advice to farmers on suitable wheat varieties. Receiving an inquiry from W.H. McFarlane of Lanigan, Saskatchewan, on the desirability of sowing Durum, a wheat useful solely in the manufacture of macaroni, Motherwell suggested that more wheat of this kind be grown.[11] However, he cautioned the enquirer to expect a limited market for his product.

> Millers generally avoid buying it for ordinary bread flour...Heretofore most of the macaroni has been imported, the domestic article not having been altogether satisfactory. This has been due in part, it is believed, to lack of good macaroni wheat and in part to lack of technical skill in the manufacture of semolina.[12]

When A. Rister of Winnifred, Alberta, declared that he had developed a hardy variety of winter wheat, Motherwell expressed interest. He suggested Rister send samples to John Bracken at the Saskatchewan Agricultural College for testing.[13] For his part Motherwell placed his faith in Red Fyfe wheat. He declared:

> We all have to admit that Red Fife is the wheat upon which the West has built its reputation and we should stick to that wherever it is likely to prove reasonably successful.[14]

But he cautioned:

> In districts where the soil shows a disposition to mature wheat slowly we think it well that settlers, particularly new settlers, should try...earlier varieties of wheat such as Stanley and Preston even though they may be only 3 or 4 days earlier. Sometimes 3 or 4 days is all the difference between success and failure in the growing of a wheat crop. Besides now land is always more susceptible to frost than the same land when it is cropped for several years.[15]

In short, although interested in various wheats, Motherwell generally recommended Red Fyfe.

Motherwell was particularly concerned with improving ploughing techniques. He was skeptical of the supposed benefits of fall ploughing:

> Speaking generally fall ploughing gives the lightest yields and stands the dry weather the worst of any of our methods of tillage, especially if the plowing is done when the weather is dry and in the heavy clay country. When land is plowed in the fall, particularly for the second crop, a mass of stubble is plowed in and a great lot of sod turned up, the most of which is so rough and dry that it is impossible to get it worked down into a fine granular condition, which is necessary in order to get the best results.[16]

However, he did realize that fall ploughing was sometimes necessary because of the shortness of the growing season. He suggested to John Parker of Yonker, Saskatchewan, that one could circumvent the problem by ploughing part of the land in the fall and the remainder in the spring. In the case of fall ploughing, the following advice should be heeded:

> Any fall plowing that you do should be done as early as possible, and shallow, and harrowed down immediately after

> the plowing, giving it one or two strokes to make a firm seed-bed. If this land is sown lightly, say with a bushel to the acre, you will get good results.[17]

Spring ploughing was also advocated since by turning over sod in the early spring, moisture-laden soil would be brought to the surface. Harrowing immediately after ploughing or at the same time would provide a good bed and, even more important, make the soil receptive to scanty dry-belt rainfall.[18]

Motherwell provided grain growers with sound advice on breaking virgin prairie sod. Early breaking the spring before cultivation was mandatory. Breaking after July 1st would only lead to problems. He wrote O.O. Winter of Rosetown, Saskatchewan, that the soil would not be sufficiently decomposed to grow wheat the following year.[19] If a farmer was willing to take a risk, land broken after the deadline could be sown lightly the following year. Discing and top tillage in early spring would work the soil down to perhaps make the cultivation feasible. However, nothing "entirely takes the place of early and well-done breaking, worked down before harvest, or backset, as the raw prairie is by this means best reduced to an arable soil full of plant food easily available for the young growing plant from the very outset."[20]

Newly introduced crops, advertised as the salvation of the dry-land farmer, were also grown by Motherwell. Most important were the Agriculture Minister's experiments with bromegrass which he began cultivating in 1901.[21] By 1907-8 he had entered production in a large way sowing 150 and then 110 acres for an average yield of 800 bushels.[22] But bromegrass created a number of problems. Motherwell found it a nuisance and had difficulty eradicating it. A more serious problem was the virtual impossibility of cleaning its seed. Motherwell wrote George Robinson of Girwin, Saskatchewan, that he found it advisable to sell his seed as it poured off the threshing machine rather than face the difficulty of cleaning it himself.[23]

Another crop Motherwell experimented with was winter rye. After learning of successful experiments with this crop during a period of drought at the Saskatchewan Agricultural College, he ordered five bushels of seed from North Dakota.[24] The experiment must have been successful because Motherwell then recommended the crop to others. In August 1914 he forwarded seed to A.G. Holmes of Alsask, Saskatchewan. He suggested seeding the grass on early-ploughed summer fallow in late August. The seed would germinate in the autumn. "As Winter Rye makes its growth in May and early June when it is comparatively cool, it thus steals a march on the drought, which when it does come later on merely assists in maturing a crop already well filled and advanced."[25] Winter rye would be ready for the binder the last week in July or the first week in August.[26] However, aside from Motherwell, and a limited number of others, the crop was not attractive to field husbandmen. Acreages remained limited.

Throughout his career Motherwell was both a propagandist of and a pioneer in dry-farming methods. He had informed farmers of proper soil-preparation and wheat-cultivation techniques by pamphlet and in personal responses to their queries. He experimented with bromegrass and winter rye, making his findings available to all interested parties. While

Motherwell was no John Bracken he, nevertheless, made a significant contribution to the popularization of dry-farming techniques.

Motherwell's Administrative Achievements

In his role as Saskatchewan's Agriculture Minister, Motherwell was a patron of agricultural education; he was ultimately responsible for establishing the Saskatchewan Agricultural College, encouraging Farmers' Institute lectures, and preparing the ground-work for co-operative experiments. However, his greatest accomplishment lay in his work as an executive member of the International Dry Farming Congress.

Motherwell served as vice-president, president, lecturer, and organizer in helping the association disseminate its dry-farming propaganda. In 1910 he was elected Vice-President of the Saskatchewan section.[27] Two years later at the Lethbridge Congress, he was promoted to president.[28] At these meetings he was in wide demand as a lecturer. In 1909 at the Congress in Billings, Montana, he delivered a paper on methods of soil conservation underlying successful grain growing in Saskatchewan, and a year later he spoke on a related topic.[29] Perhaps his greatest contribution lay in his work in organizing the 1912 Lethbridge Congress. As the leading Canadian member of the executive he recommended Angus MacKay, A.F. Mantle and W.H. Rutherford as lecturers at the annual meeting.[30] Later he suggested a number of additional speakers. Both W.J. Rutherford and John Bracken were billed to talk on soils and tillage. Professor A.R. Greig of the Saskatchewan Agricultural College was suggested for a farm-machinery topic. James Murray of Suffield, Alberta, a former superintendent of the Dominion Experimental Farm at Brandon and John Mooney of Regina, had their names bandied about for unlisted topics.[31] Motherwell's contribution to dry-land farming, while not innovative, nevertheless ranks in importance with that of William and Charles Saunders, Angus MacKay, John Bracken and Seager Wheeler, for his role as a publicist and propagandist.

CONCLUSION

The period between 1880 and 1920 constituted an important era in the history of prairie agriculture. During these years dry-land farming was made not only feasible, but desirable. Breaking, ploughing, and moisture-preservation methods were evolved to cultivate grain in a limited rainfall area, mechanical power appeared to relieve the manpower shortages that grain growing with animal power entailed. Moreover, agricultural education, both formal and informal, allowed the new information to be disseminated and the new techniques to be implemented. The efforts at making the prairie dry belt productive were obviously successful.

The era closed with the publication of three major works, *Seager Wheeler's Book on Profitable Grain Growing*, John Bracken's *Dry Farming in Western Canada* and *Crop Production in Western Canada*. In layman's language, Wheeler showed how he had refined seed selection, breaking and backsetting, summer fallowing, and ploughing to an exacting science.[1] In a more technical treatise, John Bracken analysed soil-moisture preservation, tillage principles, crop rotation, and weed control in *Dry Farming*.[2] Bracken's *Crop Production* was an instructional guide on wheat, oats, barley, rye, flax and forage-crop cultivation.[3] Wheeler's and Bracken's writings were significant because by 1920 the prairie grain grower had at his command three complete works on successful dry-belt farming methodology. Utilizing their principles, satisfactory grain crops could virtually be assured in any year with normal weather conditions.

Between 1880 and 1920, then, the new farmer had come to terms with the environment. During the 1880s, Red Fyfe had become the mainstay of prairie agriculture and summer fallowing had been perfected as a means of moisture preservation and weed control. Seed selection, disc harrowing, and bluestoning became popular in the first decade of the 20th century. Advances after 1911 included the perfection of seed selection and moisture-preservation techniques plus increased use of such novel agricultural implements as the seed drill and the sub-surface soil packer. Moreover, during this decade an ideally suited dry-belt wheat, Marquis, had made its appearance.

Advances were made in ploughing and threshing power. The ox gave way to the horse soon after the dry belt was settled. The opening of ever-increasing acreages for wheat cultivation led to the introduction of the steam tractor to supplement animal power. Proving too expensive, unwieldy and dangerous, it was soon replaced by the gas-powered tractor and by 1915, the small gas-powered tractor was in widespread use in Canada. Combined with a portable separator, each farmer could now handle all breaking, ploughing and threshing on his own farm at a reasonable cost.

The dissemination of agricultural information through agricultural societies and colleges had made dry-farming principles known throughout the Prairie provinces. Institute lecturers in Saskatchewan and Alberta spread the gospel of better grain growing. Society experiments with newly introduced crops in Saskatchewan forced field husbandmen to pay more attention to general seeding and ploughing techniques than they had in the past. With cirricula ranging from one to three years for full-length courses and several days for short courses, agricultural colleges provided grain growers with the intricate knowledge that farming required.

Dominion Experimental Farms were active in experimentation and information dissemination. Wheats such as Preston, Huron and Marquis were perfected by William and Charles Saunders. Angus MacKay, S.A. Bedford, and others, experimented with summer fallowing, packing, seeding, and forage-crop production at Indian Head and Brandon. Through personal replies to farmers queries and by publication of instructional pamphlets, the Dominion Experimental Farm System fomented innumerable advances in dry farming.

Contrary to what E.B. Ingles suggests, the development of dry-farming practices had been anything but slow and halting. Developments had appeared regularly and were quickly popularized. By 1920, all prairie farmers were aware of dry-farming techniques and, more important, most used them. For this triumph, Motherwell deserves considerable credit.

APPENDIX A. THE S. RICHARDS' DIARIES

S. Richards was an immigrant eastern Canadian farm labourer who came West in 1905, saving money until he could afford to homestead at Quill Lake, Saskatchewan, in 1907.[1] His day-by-day account of farm operations in both Ontario and on the Prairies provide ample evidence that prairie dry-land farming bore little resemblance to eastern Canadian practices, both in crops seeded and in cultivation techniques.

A typical resumé of farming practices in the Ottawa area is provided for the year 1903:

April 14 - ploughed and harrowed stony field.
15 - harrowed.
16 - sowed peas and oats.
17 - harrowed peas and oats.
21 - sowed peas.
24 - harrowing.
27 - harrowing.
May 15-16 - manuring fields.
18-19 - spreading manure.
20 - finished spreading manure.
June 6 - harrowed root ground; planted potatoes and beans in orchard.
15 - planted corn and beans.
16 - ploughing corn and beans.
19 - sowed 2 1/2 acres corn with drill seeder.
20 - sowed millet.
22 - ploughing for buckwheat.
July 6 - cultivating field potatoes and corn.[2] No summer fallowing for moisture preservation was practised; rainfall in the Ottawa area was sufficient for crop growth.

Two years later Richards arrived in the West. As a farm labourer near Brandon, Manitoba, his experiences were the following:

March 27 - cleaning grain.
28 - bluestoning.
April 3 - sowed first wheat - 14 acres.
5 - sowing fall ploughing.
8 - finished cultivating summer fallow.
10 - ploughing.
11 - sowing on summer fallow.
21 - sowing wheat.
22 - sowing and packing.
24 - harrowing.

May 1-2 - ploughing for barley.
22-27 - breaking.
July 11-15 - started to summer fallow. working on summer fallow?
24-29 - summer fallowing.
August 2 - harrowing.
5 - harrowing.
9-12 - cutting barley.
16-19 - cutting oats.
23 - weed cutting.
24-25,28 - cutting wheat.
Sept. 11 - threshing.
14 - started backsetting.
Oct. 6 - still threshing.
14 - still threshing.[3]

As a prairie farm labourer, Richards did not cultivate buckwheat, peas or corn. Moreover, he was introduced to the moisture-preserving summer fallow.

In 1909, two years after Richards had settled on his Quill Lake homestead, he was utilizing proper dry-farming methods. His record for the year consists of:

July 14 - summer fallowing.[4]
16 - summer fallowing; harrowing.
19 - summer fallowing.
20 - finished summer fallowing.
22-23 - harrowing.
August 5-6 - haying.
7 - stacking.
16 - haying.
17 - cut barley.
25-26 - cut barley.
27 - cut wheat
28 - cut pedigreed wheat.
Sept. 1-4 - cutting wheat.
6-8 - cutting wheat.
13-14 - threshing barley.
15-16 - threshing wheat.
20-30 - threshing at other people's farms.
Oct. 6-9 - ploughing.
11-12 - ploughing.
23 - ploughing, discing.
25 - discing.
26 - discing.
27 - discing, harrowing.
29-30 - ploughing.
Nov. 1-2 - ploughing.
8-11 - ploughing.
17 - finished ploughing wheat stubble, harrowing.[5]

Richards was using correct dry-farming methods.

In 1919 Richards continued to farm with the dry-farming methods he had learned as a farm labourer near Brandon. He cultivated his crops in the following manner:

April 22 - sowed wheat.
23-26 - ploughing.
May 3 - ploughing, harrowing, sowing oats.
5 - finished sowing oats.
6-8 - ploughing and harrowing, seeded oats.
13-17 - ploughing.
29 - seeded 4-5 acres barley.
June 2 - finished discing and seeding 11 acres oats, 25 acres barley.
17-19 - ploughing and harrowing.
July 4 - summer fallowing.
8-10 - summer fallowing.
15 - finished summer fallowing.
August 13 - cutting oats.
20 - cutting barley.
September 15 - commenced discing summer fallow.
November 1 - finished threshing.[6]

Richards had certainly demonstrated his ability to adapt from eastern Canada to dry-belt farming conditions.

ENDNOTES

Introduction

1 Ernest B. Ingles, "Some Aspects of Dry Land Agriculture in the Canadian Prairies to 1925." (Unpublished M.A. thesis, University of Calgary, 1973), p. 4.

2 Grant MacEwan, *Between the Red and the Rockies* (Toronto: University of Toronto Press, 1952).

3 Mary W.M. Hargreaves, *Dry Farming in the Northern Great Plains, 1900-1925* (Cambridge: Harvard University Press, 1957).

4 Ibid., p. 541.

5 John Bracken, *Dry Farming in Western Canada* (Winnipeg: Grain Growers' Guide, Ltd., 1921), pp. x-xiii.

6 John Bracken, *Crop Production in Western Canada* (Winnipeg: Grain Growers' Guide, Ltd., 1920).

7 Seager Wheeler, *Seager Wheeler's Book on Profitable Grain Growing* (Winnipeg: Grain Growers' Guide, Ltd., 1919).

Introduction of Dry-Farming Techniques on the Prairies: Wheat Cultivation

1 North-West Territories. Legislative Assembly. *Annual Report of the Department of Agriculture for the year 1900,* Sessional Papers, 1910, pp. 20, 21; Saskatchewan. Legislative Assembly. *Annual Reports of the Department of Agriculture for the years 1905-1920*.

2 Stanley M. Murray, *The Valley Comes of Age: A History of Agriculture in the Valley of the Red River of the North, 1812-1920* (Fargo: North Dakota Institute for Regional Studies, 1967), pp. 36-37.

3 Ibid., p. 40.

4 Ibid., p. 44.

5 Ibid., p. 39.

6 Robert L. Jones, *History of Agriculture in Ontario, 1613-1880* (Toronto: University of Toronto Press, 1946), p. 89.

7 Ibid., p. 91.

8 "White vs. Red Fyfe," *Nor'West Farmer* (hereafter cited as N-W Farmer) (Winnipeg, Manitoba), July 1885, p. 144.

9 "Hard vs Soft Wheat," Ibid., November 1885, p. 283.

10 Ibid.

11 "Varieties of Wheat," Ibid., April 1892, pp. 102-3.

12 "The Failure of Ladoga," Ibid., April 1893, p. 106.

13 Ibid.

14 Ibid.

15 "Varieties of Wheat," Ibid., April 1892, pp. 102-3.

16 F.L. Morton, "Seeding," Ibid., April 1892, p. 100.

17 "Press Drills," Ibid., September 1889, pp. 246-47.

18 Ibid.

19 "The Press Drill," Ibid., May 1891, p. 130.

20 Ingles, op. cit., p. 8.

21 "Prize Essay on Summer Fallowing," *N-W Farmer*, April 1886, p. 440.

22 "Summer Fallowing," Ibid., May 1886, pp. 469-70.

23 Ibid.

24 "Summer Fallowing," Ibid., June 1886, p. 501.

25 Ibid.

26 R. Waugh, "Summer Fallowing," Ibid., July 1891, pp. 187-88.

27 Ingles, op. cit., p. 11.

28 "How to Bluestone," *N-W Farmer*, January 1893, pp. 24-25.

29 Ibid.

30 "Hints to Homesteaders on Breaking Land," *Farm Crops* (Winnipeg, Manitoba), June 1909, p. 11.

31 Ibid.

32 Ibid.

33 "Tillage Processes," *The Grain Growers' Guide* (hereafter cited as *GGG*), 16 March 1970, pp. 7, 10, 11.

34 Ibid.

35 Ibid.

36 "Plowing vs. Discing," *GGG*, 28 Sept. 1910, p. 23.

37 Ibid.

38 Ibid.

39 "Selection of Seed Grain," *Farm Crops*, May 1907, pp. 5-6.

40 Ibid.

41 John Bracken, "How Can We Produce The Best Seed Grain?" *The Canadian Thresherman* (Winnipeg, Manitoba), January 1907, pp. 8, 63-65.

42 Ibid.

43 Ibid.

44 Ibid.

45 "Eradication of Noxious Weeds," *Farm Crops*, May 1909, pp. 18-20.

46 Ibid.

47 Ibid.

48 Ibid.

49 Ibid.

50 Ibid.

51 Ibid.

52 "Expert Information on Wheat Growing," *The Grain Dealers' Journal*, (Winnipeg), February 1906, p. 10.

53 "Grain Smuts and Their Prevention," *The Canadian Thresherman*, April 1906, pp. 32, 74-76.

54 Ibid.

55 S.A. Bedford, "Requisites to Success," *GGG*, 9 March 1910, pp. 7, 9.

56 Ibid.

57 W.R. Motherwell, "Wheat Growing in the Canadian West," *Farm Crops*, June 1909, pp. 5-7.

58 Ibid.

59 Ibid.

60 Saskatchewan. Legislative Assembly. *Annual Report of the Department of Agriculture for the Year 1909. Sessional Papers, 1909*. p. 135.

61 Ibid.
62 Seager Wheeler, "Seed Selection," GGG, 1 Dec. 1915, pp. 19, 55-58.
63 Ibid.
64 Ibid.
65 Seager Wheeler, "The Soil and the Seed," GGG, 3 March 1915, pp. 11-12, 22.
66 Seager Wheeler, "Conserving Soil Fertility," Ibid., 12 April 1916, pp. 7, 32-36.
67 Ibid.
68 Ibid.
69 Ibid.
70 Ibid.
71 "Farm Weeds," Ibid., 1 July 1914, pp. 16, 22.
72 Ibid.
73 Ibid.
74 Ibid.
75 "The Profit Robber," Ibid., 23 Dec. 1914, pp. 11, 15.
76 Ibid.
77 John Bracken, Dry Farming in Western Canada, p. 107.
78 Ibid., p. 110.
79 Ibid., p. 113.
80 Ibid., p. 114.
81 Ibid., p. 116.
82 Ibid., p. 118.
83 Seager Wheeler, Seager Wheeler's Book, pp. 105-8.
84 John Bracken, Dry Farming.
85 Seager Wheeler, Seager Wheeler's Book, p. 31.
86 Ibid.
87 Ibid., p. 32.
88 Ibid.
89 Ernest B. Ingles, "Some Aspects of Dry-Land Agriculture," p. 42.
90 Ibid.
91 Ibid., p. 44.
92 Saskatchewan. Department of Agriculture. Annual Report, 1920, Sessional Papers, p. 15.
93 Ibid.
94 Saskatchewan. Department of Agriculture. Annual Report, 1919, Sessional Papers, p. 107.
95 Saskatchewan. Department of Agriculture. Annual Report, 1920, Sessional Papers, p. 15.

Supplementing Wheat with Other Crops

1 John Bracken, Dry Farming, p. 182.
2 W.C. McKillican, "The Why and How of Crop Rotation," GGG, 22 Jan. 1919, p. 7.
3 John Bracken, Dry Farming, p. 197.
4 Ibid., p. 197.
5 Ibid., p. 199.
6 Ibid., p. 200.
7 Ingles, op. cit., pp. 29-30.
8 Ibid., p. 31.

9 Ibid., pp. 30-31.

10 John Bracken, *Dry Farming*, pp. 209-10.

11 Saskatchewan. Department of Agriculture. *Annual Report, 1900*, Sessional Papers, pp. 11-68.

12 John Bracken, *Crop Production*, pp. 157-58. If oats were planted as a follow-up to wheat, spring ploughing was recommended.

13 John Bracken, *Dry Farming*, p. 197.

14 John Bracken, *Crop Production*, p. 159.

15 Ibid., p. 150.

16 Ibid.

17 John Bracken, *Dry Farming*, p. 197.

18 Saskatchewan Archives, Saskatoon. Agricultural Society Records, Ag 3, File 100, W.R. Motherwell to C.S. Noble, Noble, Alberta, 10 March 1913.

19 Ibid.

20 Saskatchewan. Department of Agriculture, *Annual Report, 1900*, pp. 16-111.

21 John Bracken, *Crop Production*, p. 171.

22 Ibid., p. 172.

23 Ibid., p. 174.

24 Ibid., p. 178.

25 Ibid.

26 Ibid.

27 Saskatchewan. Department of Agriculture, *Annual Report, 1902*, pp. 16-112.

28 John Bracken, *Crop Production*, p. 203.

29 Ibid., p. 207.

30 Ibid., p. 213.

31 Ibid., p. 209.

32 Saskatchewan Archives, Saskatoon. Department of Agriculture. *Field Crops Branch Records*, Ag 3. File 38. Thompson & Sons, Winnipeg to A.F. Mantle, Regina, 26 Nov. 1910.

33 Ibid.

34 Ibid., Ag 3, File 41, W.W. Thomson, Ottawa to C.M. Brisbin, Holden, Alberta, 1 May 1916.

35 Ibid., Ag 3, File 41, F.H. Auld, Regina to James Dougall, General Agricultural Agent, C.P.R. Winnipeg, 16 March 1917.

36 "Moving the Corn Line North," *GGG*, 5 Oct. 1910, p. 7.

37 Ibid.

38 Saskatchewan Archives, Saskatoon. Department of Agriculture. *Field Crops Branch Records*, Ag 3, File 21, Extract from *Regina Leader*, 7 Feb. 1916.

39 Ibid., Ag 3, File 21, Vere C. Brown, Superintendent of Central Western Branches, The Canadian Bank of Commerce, Winnipeg to A.F. Mantle, Regina, 15 Feb. 1915.

40 Ibid., Ag 3, File 21, Thomas Acheson, General Agricultural Agent, C.P.R. Winnipeg to W.R. Motherwell, 23 March 1915.

41 Ibid., Ag 3, File 21, A.F. Mantle to V.C. Brown, 23 March 1915.

42 George A. Clark and M. Oscar Malte, *Fodder and Pasture Plants* (Ottawa: Department of Agriculture, 1913), p. 83.

43 Ibid.

44 Saskatchewan Archives, Saskatoon. W.R. Motherwell Papers. No. 12,112-13, W.R. Motherwell to Dr. Webber, Cornell University, Ithaca, N.Y., 12 Jan. 1911.
45 Ibid., No. 12,077, Motherwell to Steele, Briggs Co. Winnipeg, n.d.
46 Ibid., No. 12,085. Motherwell to George Robinson, Girvin, Saskatchewan, 30 Oct. 1908.
47 Ibid., No. 12,077. Motherwell to Steele, Briggs, Co., n.d. Winnipeg.
48 Ibid., No. 12,085. Motherwell to Robinson, 30 Oct. 1908.
49 Alfalfa was originally cultivated by the ancient Greeks and Romans. Introduced to continental Europe in the 16th century, it made its way to the United States in 1854 when it was introduced to California. Charles V. Pipe, Forage Plants and Their Culture (New York: Macmillan, 1914), pp. 305-6.
50 J.E. Gustus, "Alfalfa for Western Canada," GGG, 10 June 1914, pp. 10.
51 J.E. Gustus, "Alfalfa - A Prosperous Yankee Settler," GGG, 20 March 1912, pp. 8, 28.
52 J.E. Gustus, "Alfalfa for Western Canada," GGG, 10 June 1914, p. 10.
53 Ibid.
54 John Bracken, "The Culture of Alfalfa in Saskatchewan," The Canadian Thresherman, June 1911, pp. 7-11.
55 Ibid., p. 8.
56 Alexander Stuart, "Alfalfa and How to Grow It," GGG, 25 Feb. 1914, p. 14.
57 John Bracken, "The Culture of Alfalfa in Saskatchewan," The Canadian Thresherman, June, 1911, pp. 7-11.
58 "The Farm Garden - Competitive Essay," N-W Farmer, May 1888, p. 127.
59 Ibid.
60 "Fresh Vegetables for the Farm," The Canadian Thresherman, March 1907, pp. 12, 16-18, 53.
61 Ibid., p. 18.
62 Ibid.
63 Ibid., p. 18.
64 Ibid.
65 Letters to the Editor, "Gardening on the Farm," GGG, 10 April 1912, pp. 13-15, 22.

Mechanization

1 Grant MacEwan, Power for Prairie Ploughs (Saskatoon: Western Producer Books), 1971, p. 8.
2 Ibid., p. 29.
3 Ibid., p. 23.
4 Ibid.
5 "Steam Plowing," N-W Farmer, August 1885, p. 179.
6 Ibid.
7 Ibid.
8 Grant MacEwan, Power for Prairie Ploughs, p. 41.
9 Reynold M. Wik, Steam Power on the American Farm (Philadelphia: University of Pennsylvania Press, 1963), p. 18.

10 Ibid., p. 20.

11 Glenbow Foundation Archives, Calgary, O.S. Longman, "Pioneers & Pioneering in Western Canada." (unpublished manuscript), p. 52.

12 Ibid., p. 54.

13 Ibid., p. 55.

14 Ibid.

15 Ibid., p. 56.

16 Ibid.

17 Ibid., p. 57.

18 Ibid., pp. 57-58.

19 Ibid., p. 58.

20 Ibid., pp. 60-61.

21 Ernest B. Ingles, "Some Aspects of Dry-Land Agriculture in the Canadian Prairies to 1924," p. 99.

22 Ibid., p. 100.

23 Ibid., p. 101.

24 A. Burness Greig, "Traction Plowing by System," The Canadian Thresherman, September 1906, pp. 3-9.

25 Ibid., p. 5.

26 Ibid.

27 Ibid., p. 9.

28 Ibid., p. 8.

29 E.J. Trott, "The Modern Grain Separator," GGG, 19 Aug. 1914, p. 7, 11.

30 Ibid., p. 7.

31 Ibid.

32 Ibid.

33 Ibid.

34 L.W. Ellis, "Development of Traction Plowing," Canadian Farm Implements, June 1910, pp. 7-10.

35 R.M. Wik, Steam Power on the American Farm, pp. 100-1.

36 L.W. Ellis, "Development of Traction Plowing," Canadian Farm Implements, June 1910, pp. 9.

37 Ibid., pp. 9-10.

38 L.W. Ellis, "Development of Traction Plowing," Part II, Canadian Farm Implements, July 1910, pp. 10-13.

39 "Handling a Traction Engine," Canadian Thresherman, August 1906, p. 106.

40 Ibid.

41 Saskatchewan Archives, Saskatoon. S. Richards, "My First Five Years in Canada 1900-1925 and Continued to the Year 1950." (unpublished manuscript), p. 53.

42 "The Care of a Threshing Outfit," Canadian Thresherman, October 1904, pp. 36-37.

43 Ibid., p. 36.

44 Ibid.

45 North-West Territories, Department of Agriculture, Annual Report, Sessional Papers, 1903, p. 110.

46 It was assumed that the capital outlay for steam-ploughing equipment was $3500.

47 Ibid.

48 "Brought by the Postman," Canadian Thresherman, September 1906, pp. 8, 10, 12, 14-16, 18-19, 22-25, 69-73.

49 Ibid., p. 70.
50 Ibid., p. 71.
51 Ibid.
52 "The Gasoline Traction," Canadian Thresherman, January 1910, p. 26.
53 Ibid.
54 R.M. Wik, Steam Power on the American Farm, p. 203.
55 Ibid., pp. 203-4.
56 Ibid., p. 204.
57 Ibid.
58 Ibid., p. 205.
59 Ibid.
60 L.J. Smith, "Power on the Farm," Gas Power Age, March 1912, p. 12.
61 Ibid.
62 A.M. Brown, "Threshing with Gas Power," Ibid., January 1911, p. 26.
63 C.V. Hull, "Successful Operation of the Gas Tractor," Ibid., September 1912, p. 17.
64 Ibid.
65 Ibid., p. 19.
66 A.C. Campbell, "The Tractor Fuel Problem," GGG, 14 March 1917, p. 44.
67 Ibid., p. 144.
68 "The Modern Farm House," GGG, 26 June 1912, p. 7.
69 Ibid.
70 "Does a Tractor Pay?" GGG, 17 March 1915, p. 28.
71 Ibid., p. 29.
72 "Combination Threshing Outfits," GGG, 28 June 1916, p. 7.
73 Ibid., p. 19.

Effect of Agricultural Societies and Agricultural Colleges on Field-Crop Production

1 F.H. Auld, "Farmers' Institutes in the North-West Territories," Saskatchewan History, Vol. 10, No. 2 (Spring 1957), p. 41.
2 Ibid., quoted by F.H. Auld.
3 Ibid.
4 Ibid., p. 48.
5 Ibid., p. 49.
6 North-West Territories. Department of Agriculture. Annual Report, 1898. North-West Territories Pamphlets, p. 15.
7 Ibid., Annual Report, 1903, Sessional Papers, p. 78.
8 Ibid.
9 Ibid., p. 80.
10 Ibid., p. 79.
11 Ibid., Annual Report, 1906, p. 92.
12 Ibid., Annual Report, 1903, pp. 96-97.
13 Ibid., p. 97.
14 Ibid.
15 Ibid.
16 Ibid., Annual Report, 1901, pp. 111-12.
17 Ibid.
18 Ibid., Annual Report, 1903, pp. 99-100.

19 Ibid., p. 94.
20 Ibid., for terms of The Agricultural Societies Ordinance see p. 95.
21 Ibid.
22 Ibid., *Annual Report, 1908*, p. 115.
23 Ibid.
24 Ontario. Department of Agriculture. *Annual Report of the Commissioner of Agriculture and Arts*. *Annual Report of the Ontario Agricultural College*, Sessional Papers, 1881, Guelph. pp. 447-49.
25 Ibid., p. 459.
26 Ibid., pp. 447-49.
27 Ibid.
28 Ibid., pp. 452-53.
29 Ibid., p. 452.
30 Ibid., p. 453.
31 Ontario. Department of Agriculture. *Annual Report of the Commissioner of Agriculture and Arts*. *Annual Report of the Ontario Agricultural College*, Sessional Papers, 1880, Guelph. p. 327.
32 Ibid., 1881, p. 459.
33 *The O.A.C. Review*, January 1905, p. 252.
34 W.J. Black, "Manitoba Agriculture and the Agricultural College," *The Canadian Thresherman*, December 1966.
35 *O.A.C. Review*, October 1903, p. 17.
36 "Old Boys in the West," Vol. 18, No. 8 (May 1906), p. 369.
37 University of Saskatchewan. *Calendar* (Saskatoon, 1910-11), p. 45.
38 *Transcripts of John Bracken*, Ontario Agricultural College, Guelph, Ontario. W.R. Heath, Associate Registrar, Student Records and Programs, has kindly made records available to me.
39 Walter C. Murray, "The Farmers' Training School," *GGG*, 17 Aug. 1910, p. 4.
40 Ibid.
41 Ibid.
42 University of Saskatchewan. *Calendar* (Saskatoon, 1910-11), p. 49.
43 Ibid., p. 66.
44 Ibid.
45 Ibid., p. 64.
46 University of Saskatchewan. *Calendar* (Saskatoon, 1912-13), p. 84.
47 Ibid., p. 80.
48 Ibid., p. 85.
49 University of Saskatchewan, *Calendar* (Saskatoon, 1910-11), p. 64; (1912-13), p. 84.
50 Ibid., (1912-13), p. 83.
51 Saskatchewan. Department of Agriculture, *Annual Report, 1908*, Sessional Papers, p. 54.
52 Ibid.
53 Ibid., p. 55.
54 Ibid., p. 56.
55 Ibid., *Annual Report, 1910*, pp. 61-62.
56 Ibid., *Annual Report, 1914*, p. 43.
57 Ibid., p. 44.
58 Ibid., p. 43.
59 Ibid., *Annual Report, 1918*, p. 281.

60 Ibid.
61 Ibid., p. 282.
62 Ibid., pp. 282-83.
63 Ibid., p. 283.
64 Ibid.
65 "Gasoline Engine Courses by Saskatchewan College of Agriculture," Gas Power Age, January 1912, p. 23.
66 Saskatchewan. Department of Agriculture, I 98 Agricultural Societies' Records. Crop Experiments by Agricultural Societies, 1906-58. John Bracken, Superintendent of Fairs and Institutes to H.O. Wilson, Abernethy, 26 Jan. 1909; 25 Feb. 1909.
67 Ibid., I 99 Crop Experiments by Agricultural Societies, "Instruction for Work with Winter Wheat," 1909-10.
68 Ibid., I 98 Crop Experiments by Agricultural Societies, J.J. Bell to John Bracken, 31 May 1909.
69 Ibid., I 99 Experiments by Agricultural Societies, 1906-8, John Bracken to H.W. Caswell, Saskatoon, 2 May 1908.
70 Ibid., I 99 Experiments by Agricultural Societies, 2 Jan. 1908.
71 Ibid., I 99 Crop Experiments by Agricultural Societies, John Bracken to A.J. Colqhoun, Maple Creek, 16 Sept. 1907.
72 Ibid., I 98 Crop Experiments by Agricultural Societies, J.R. Graham, Kinistino, Saskatchewan, to John Bracken, 24 March 1908.
73 Ibid., I 98 Crop Experiments by Agricultural Societies, R.L. Kidd, Fairnede P.O., Saskatchewan to John Bracken, 30 March 1908.
74 Ibid., I 99 Crop Experiments by Agricultural Societies, George R. Fogg, Togo, Saskatchewan to John Bracken, 3 Dec. 1909.
75 Ibid., I 99 Crop Experiments by Agricultural Societies, John Bracken to E.R. Heath Co., Ltd., Winnipeg, Manitoba, 15 Nov. 1909.
76 Ibid., I 98 Crop Experiments by Agricultural Societies, J.J. Bell to John Bracken, 31 May 1909.
77 Ibid.
78 Glenbow Foundation Archives, Calgary. Department of Agriculture, Agricultural Societies' Records, Didsbury Agricultural Society, Box 27, F.A. Sundal, Secretary Taber Agricultural Society, Taber, Alberta to Duncan Marshall, Minister of Agriculture, Edmonton, Alberta, 28 Dec. 1912.
79 Ibid., Duncan Marshall to F.A. Sundal, 4 Jan. 1913.
80 Saskatchewan Archives, Regina. Department of Agriculture, Agricultural Societies' Records. I 13 Agricultural Institute Meetings 1906-09, "Farmers' Institute Meeting, 1907."
81 Ibid., "Farmers' Meetings, 1908."
82 Ibid.
83 Ibid., "Farmers' Meetings, 1909."
84 Ibid., I 135, "Farmers' Institutes 1908-10," John Bracken to W.L. Grant, MLA, Vonda, Saskatchewan, 4 Feb. 1908.
85 Ibid., I 135, "Farmers' Institutes 1908-10," H.C. Pierce, Wadesa, Saskatchewan to John Bracken, 26 Feb. 1909.
86 Ibid., I 135, "Farmers' Institutes 1908-10," Dr. H.P. Moreau, Howell, Saskatchewan to John Bracken, 8 March 1909.
87 Ibid., Box 91, Trocher, "Prizes for 1910 Fall Fair."
88 Ibid., Box 78, Sedgewick, "Sedgewick Agricultural Society's 1917 Field Competitions."

89 Saskatchewan Archives, Regina. Saskatchewan. Department of Agriculture. Agricultural Societies' Records. I 199, Plowing Matches, 1902-20. J. MacGregor Smith, "The Plowing Match." (Pamphlet), p. 4.

90 Ibid., I 199, Plowing Matches, 1902-20. A.F. Mantle, Deputy Minister of Agriculture to C.E. Flack, Battleford, Saskatchewan, 7 April 1911.

91 Ibid., I 199, J. MacGregor Smith, "The Plowing Match," pp. 7, 10.

92 Ibid., I 99, "Elstow Agricultural Society Plowing Match Rules," 1910.

93 Ibid., I 199, J. MacGregor Smith, "The Plowing Match," p. 12.

94 Ibid., p. 16.

95 Ibid., I 199, Plowing Matches, 1902-20, F.H. Auld to E.H. Heath Co. Ltd., Winnipeg, 5 June 1911.

96 Ibid., I 199, Plowing Matches 1902-20, J. MacGregor Smith, "The Plowing Match," p. 4.

97 Advertisement, "Learn Gas Engineering," Gas Power Age, Jan. 1912, p. 5.

98 "First Gas Traction Engine School of the I.H.C.," Gas Power Age, March 1912, p. 16.

99 "The Great Gas Engine Educational Movement," Gas Power Age, April 1912, p. 19.

100 Ibid.

101 Ibid.

102 "The Engine Schools of 1914," Gas Power Age, February 1914.

103 Saskatchewan Archives, Regina. Department of Agriculture, Agricultural Societies' Records. I 6, F.H. Auld, Director of Extension Work, Regina to F.R. Munro, Winnipeg, 3 Nov. 1910. Letter not sent.

104 Saskatchewan Archives, Saskatoon. W.R. Motherwell Papers, "Your Instructors" (promotional pamphlet), No. 554-557.

105 Saskatchewan Archives, Regina, Agricultural Societies' Records. I 6, F.H. Auld to F.R. Munro, 3 Nov. 1910. Letter not sent.

106 Saskatchewan Archives, Regina, W.R. Motherwell Papers, No. 4047-48, John T Burns, Spokane, Washington, Secretary-Treasurer, International Dry Farming Congress to Dr. James Robertson, Ontario Agricultural College, Guelph, Ontario, 5 Aug. 1910.

107 Ibid.

108 W.R. Motherwell Papers, No. 4061, John T. Burns, Spokane, to W.R. Motherwell, Regina, 30 Aug. 1910.

109 Motherwell Papers, No. 4076-77, "The Dry Farming Congress Bulletin," 15 Sept. 1910.

110 Ibid.

111 Motherwell Papers, No. 4090, J.L. Manuraing, Secretary, Lethbridge Board of Trade, Lethbridge to W.R. Motherwell, Regina, 16 April 1912.

112 Motherwell Papers, No. 4353, W.C. Palmer, North Dakota Agricultural College, Fargo to W.R. Motherwell, Regina, 6 Nov. 1912.

113 Motherwell Papers, No. 4357, John T. Burns, Lethbridge to W.R. Motherwell, Regina, 6 Nov. 1912.

114 John Bracken, "The Dry Farming Congress," Public Service Monthly (Regina, Saskatchewan), November 1914, p. 104.

115 Ibid., p. 103.

Effects of Dominion Experimental Farms on Farm Improvement

1 Public Archives of Canada (hereafter cited as PAC), Department of Agriculture. RG17 170.1, Vol. 2812, "Dominion Experimental Farms Founded Fifty Years Ago - Their Origin and Development." (unpublished manuscript), p. 2.

2 PAC, Department of Agriculture. RG17 170.1, Vol. 2812, "Canada's Experimental Farm System - Establishing the First Farm." (manuscript), p. 1.

3 Ibid.

4 PAC, Department of Agriculture. RG17 170.1, Vol. 2812, "Dominion Experimental Farms Founded Fifty Years Ago - Their Origin and Development," p. 3.

5 PCA, Department of Agriculture. RG17 AI Vol. 467, No. 51,040, William Saunders to John Lowe, Department of Agriculture, Ottawa, 1 Jan. 1886.

6 Canada. Dominion Experimental Farm Reports, Sessional Papers, No. 10, "The Agricultural Colleges and Experimental Stations, with Suggestions Relating to Experimental Agriculture in Canada," 1887, pp. 211-67.

7 Ibid., pp. 268-69.

8 Ibid., p. 268.

9 Ibid., pp. 268-69.

10 Ibid., pp. 269-70.

11 Ibid., p. 270.

12 PAC, Department of Agriculture. RG17 170.1, Vol. 2812, "Canada's Experimental Farm System - Establishing the First Farm," p. 2.

13 PAC, Department of Agriculture. Records of the Minister, Deputy Minister, and Secretary, RG17 AI, Vol. 513, No. 56,533, A.M. Burgess, Department of the Interior to John Lowe, 16 Nov. 1886.

14 Ibid., Vol. 513, No. 56,501, Jacob Erratt to John Carling, Minister of Agriculture, Ottawa, 20 Nov. 1886.

15 Ibid., Vol. 523, No. 57,816, J.G. Hughes, Brandon to John Carling, Ottawa, 28 Jan. 1887.

16 Ibid., Vol. 524, No. 58,107, J.C. Robinson et al., Brandon to John Carling, Ottawa, 4 April 1887.

17 Ibid., Vol. 566, No. 64,716, Fred W. Stobart, Vice-President, Bell Farm Company Limited to William Saunders, Ottawa, 25 Oct. 1887.

18 Ibid., Vol. 543, No. 60,611, "Experimental Farm Expenditures for 1887-88 Proposed."

19 PAC, Department of Agriculture. RG17 170.1, Vol. 2812. General, Angus MacKay's Obituary. Taken from the Winnipeg Evening Tribune, 11 June 1931.

20 Ibid.

21 Ibid., "Dr. Wm. Saunders and His Relationship to Canadian Agriculture." (manuscript), p. 1.

22 Ibid.

23 Ibid., p. 3.

24 Ibid., p. 4.

25 Ibid., p. 6.

26 PAC, Department of Agriculture. RG17 170.1, Vol. 2812, General, E.S. Archibald, "Charles Edward Saunders." (pamphlet)

27 A. Reginald Buller, Essays on Wheat (New York: Macmillan, 1919), p. 151.
28 Ibid., pp. 151-52.
29 Ibid., quoted p. 152.
30 Ibid., p. 175.
31 Ibid., p. 158.
32 Ibid., p. 167.
33 Canada. Dominion Experimental Farm Reports, Sessional Papers, Indian Head, 1890, p. 136.
34 Ibid., Brandon, 1892, p. 248.
35 Ibid., Indian Head, 1912, p. 399.
36 Ibid., Brandon, p. 354.
37 Ibid., Brandon, 1890, p. 125.
38 Ibid.
39 Ibid., Indian Head, 1891, p. 275.
40 Ibid., Brandon, 1892, p. 255.
41 Ibid., Brandon, 1894, p. 237.
42 Ibid., Indian Head, 1894, p. 277.
43 Ibid., Brandon, 1894, p. 236.
44 Ibid., Indian Head, 1895, p. 340; Indian Head, 1898, p. 361.
45 Ibid., Indian Head, 1898, p. 361.
46 Ibid., Indian Head, 1898, p. 362.
47 Ibid.
48 Ibid., Brandon, 1897, p. 337.
49 Ibid., pp. 338-39.
50 Ibid., Brandon, 1912, p. 371.
51 Ibid., p. 372.
52 Ibid., Indian Head, 1912, p. 409.
53 Ibid., Lacombe, 1912, p. 491.
54 Ibid.
55 Ibid., Brandon, 1913, p. 291.
56 Ibid., Indian Head, 1915, p. 295.
57 Department of Agriculture Library, Central Experimental Farm, Ottawa. Charles Edward Saunders Letter Books, Vol. I, Saunders to W.H. Small, Gilbert Plains, Manitoba, 18 Jan. 1904.
58 Saunders Letter Book, Vol. I, Saunders to J.B. Parker, Umatilla, Manitoba, 18 Feb. 1904.
59 Saunders Letter Book, Vol. II, Saunders to Herbert Parker, Cummings, Alberta, 30 Sept. 1908.
60 Saunders Letter Book, Vol. II, Saunders to W.H. Fairfield, Lethbridge, Alberta, 2 Dec. 1908.
61 Canada. Department of Agriculture, Bulletin No. 4, William Saunders, "Ladoga Wheat," 1889.
62 Ibid., pp. 8-21.
63 Ibid., p. 28.
64 Canada. Department of Agriculture, Bulletin No. 18, William Saunders, "Ladoga Wheat," 1893, p. 14.
65 Saunders Letter Book, Vol. II, Saunders to Angus MacKay, Indian Head, Saskatchewan, 26 June 1906.
66 Canada. Department of Agriculture. Exhibition Circulars, No. 3, C.E. Saunders, "Varieties of Grain Recommended by the Dominion Cerealist."

67 Canada. Department of Agriculture. Bulletin No. 21, William Saunders, "Results of Experiments with Early, Medium and Late Sowings of Grain," 1895.

68 Canada. Department of Agriculture. Bulletin No. 15, Second Series. J.H. Grisdale, "Preparing Land for Grain Crops on the Prairies," 1913.

69 Canada. Department of Agriculture. Bulletin No. 3, James Fletcher, "Smuts Affecting Wheat," 1888.

70 Canada. Department of Agriculture. Seed Branch. 5.3 E.H. Faull, "Bunt or the Stinking Smut of Wheat," n.d. However, publication can be estimated as 1908-11.

71 Saskatchewan Archives, Regina. Department of Agriculture. Agricultural Societies' Records, I 120, J.W. Proctor, District Passenger Agency, C.P.R., Brandon to F.H. Auld, University of Saskatchewan, Saskatoon, 17 Oct. 1911.

72 Ibid., I 120, F.H. Auld, Saskatoon to W.R. Motherwell, Regina, 18 July 1911.

73 Ibid., I 120, Advertisement of Excursion to Rosthern, Saskatchewan, 25 July 1911.

74 Ibid., I 120, Advertisement for Excursion to Rosthern, Saskatchewan, 20 July 1920.

W.R. Motherwell's Contribution to Dry Farming

1 Ontario. Annual Report of the Ontario Agricultural College, Sessional Papers, 1881, pp. 447, 452.

2 Ibid., 1880, p. 327; 1881, p. 459.

3 Saskatchewan. Department of Agriculture. Bulletin No. 21, W.R. Motherwell, "Methods of Soil Cultivation Underlying Successful Grain Growing in the Province of Saskatchewan," 1910.

4 Ibid., Second Address, pp. 9-10.

5 Ibid., First Address, p. 4.

6 Ibid., pp. 4-5.

7 Ibid., Second Address, p. 10.

8 W.R. Motherwell, "Wheat Growing in the Canadian West," Farm Crops, June 1909, pp. 5-7.

9 Ibid., p. 6.

10 W.R. Motherwell Papers, No. 987, W.R. Motherwell, "Ten Dry Farming Commandments," Saskatchewan Department of Agriculture Bulletin.

11 Motherwell Papers, No. 6289, W.H. McFarlane, Lanigan, Saskatchewan to W.R. Motherwell, Regina, 15 Jan. 1910; No. 6290-2 Motherwell to McFarlane, 19 Jan. 1910.

12 Motherwell Papers, No. 6290-2 Motherwell to McFarlane, 19 Jan. 1910.

13 Motherwell Papers, No. 6337-8 Motherwell to A. Rister, Winnifred, Alberta, 25 Sept. 1915.

14 Motherwell Papers, No. 6269 Motherwell to Richard Waugh, Winnipeg, Manitoba, 13 Sept. 1907.

15 Ibid.

16 Motherwell Papers, No. 1013-14, Motherwell to John Parker, Yonker, Saskatchewan, 25 Aug. 1910.

17 Ibid.

18 Ibid.

19 Motherwell Papers, No. 1016-17, Motherwell to O.O. Winter, Rosetown, Saskatchewan.

20 Ibid.

21 Motherwell Papers, No. 12,112-13, Motherwell to Dr. Webber, Cornell University, Ithaca, New York. 12 Jan. 1911.

22 Motherwell Papers, No. 12,077, Motherwell to Steele, Briggs & Company, Winnipeg, Manitoba, n.d.

23 Motherwell Papers, No. 12,085, Motherwell to George Robinson, Girwin, Saskatchewan, 30 Oct. 1908.

24 Motherwell Papers, No. 6328, Motherwell to W.R. Porter, Superintendent of Demonstration Farms, Fargo, North Dakota, 18 July 1813.

25 Motherwell Papers, No. 6331-2, Motherwell to A.G. Holmes, Editor, Alsask News, Alsask, Saskatchewan, 26 Aug. 1914.

26 Ibid.

27 Motherwell Papers, No. 3986, Officers of the Dry Farming Congress, 1910.

28 Motherwell Papers, No. 4353, W.C. Palmer, North Dakota Agricultural College, Fargo, North Dakota to W.R. Motherwell, Regina, 6 Nov. 1912.

29 Saskatchewan. Department of Agriculture. Pamphlet No. 21, "Methods of Soil Conservation Underlying Successful Grain Growing in Saskatchewan," 1910.

30 Motherwell Papers, No. 4238, Motherwell to John F. Burns, Secretary, International Dry Farming Congress, Lethbridge, 30 March 1912.

31 Motherwell Papers, No. 4333, John L. Burns, Lethbridge to Professor A.M. McOmie, University of Arizona, Tucson, Arizona, 24 Sept. 1912.

Conclusion

1 Seager Wheeler, Seager Wheeler's Book, pp. vii-x.

2 John Bracken, Dry Farming, pp. ix-xvi.

3 John Bracken, Crop Production, pp. ix-xv.

BIBLIOGRAPHY

Auld, F.H. "Farmers Institutes in the North-West Territories," Saskatchewan History, Vol. 10, No. 2 (Spring 1957), pp. 41-54.

---. "The Territorial Exhibition, 1895," Saskatchewan History, Vol. 15, No. 1 (Winter 1962), pp. 19-29.

Bracken, John. 1920. Crop Production in Western Canada. Grain Growers' Guide, Ltd., Winnipeg.

---. 1921. Dry Farming in Western Canada. Grain Growers' Guide, Ltd., Winnipeg.

Buller, A. Reginald. 1919. Essays on Wheat. Macmillan, New York.

Canada. Department of Agriculture. Pamphlets and Bulletins of Dominion Experimental Farms, 1887-1922, Department of Agriculture Library, Ottawa, Ontario.

Canada. Dominion Experimental Farm Reports, Sessional Papers, 1889-1918.

Canadian Farm Implements. 1905-19. Winnipeg, Manitoba.

Canadian Thresherman. 1903-13. Winnipeg, Manitoba.

Clark, George A. and M. Oscar Malte. 1913. Fodder and Pasture Plants. Department of Agriculture, Ottawa.

Department of Agriculture Library, Central Experimental Farm, Ottawa, Ontario. 1903-11. Charles Edward Saunders, Papers.

Ellis, L.W. and A. Rumely. 1911. Power and the Plough. Doubleday, Page & Company, New York.

Farm Crops. 1907-10. Winnipeg, Manitoba. (Preceded by The Grain Dealers Journal, 1905-6.)

Farmers' Advocate. 1890-1903. Winnipeg, Manitoba.

Gas Power Age. 1910-14. Winnipeg, Manitoba.

Glenbow Foundation Archives, Calgary Alberta. 1907-55. Department of Agriculture. Records of Agricultural Societies Disorganized.

J.J. Case, Papers, 1909-41. Calgary.

Erikson, Lars Peter. "History and Biographical Sketch, Olds School of Agriculture," n.d., manuscript.

Longman, O.S. 1963. "Pioneers and Pioneering in Western Canada," manuscript.

Grain Growers' Guide. 1908-22. Winnipeg, Manitoba.

Gray, R.B. 1954. Development of the Agricultural Tractor in the United States. Vol. I, United States Department of Agriculture.

Hargreaves, Mary W.M. 1957. Dry Farming in the Northern Great Plains, 1900-1925. Harvard University Press, Cambridge.

---. "Dry Farming Alias Scientific Farming," Agricultural History, 22 (January 1948), pp. 39-56.

Ingles, Ernest B. 1973. "Some Aspects of Dry Land Agriculture in the Canadian Prairies to 1925." Unpublished M.A. thesis, University of Calgary.

Jones, Robert L. 1946. History of Agriculture in Ontario, 1613-1880. University of Toronto Press, Toronto.

Kirk, Lawrence E., "Early Years in the College of Agriculture," Saskatchewan History, Vol. 12, No. 1 (Winter 1959), pp. 23-36.

MacEwan, Grant. 1950. Agriculture on Parade. Thomas Nelson & Sons, Toronto.

---. 1952. Between the Red and the Rockies. University of Toronto Press, Toronto.

---. 1958. Fifty Mighty Men. Modern Press, Saskatoon.

---. 1971. Power for Prairie Ploughs. Western Producer Books, Saskatoon.

---. n.d. The Sodbusters. Thomas Nelson & Sons, Toronto.

Murray, Stanley M. 1967. The Valley Comes of Age: A History of Agriculture in the Valley of the Red River of the North, 1812-1920. North Dakota Institute for Regional Studies. Fargo.

North-West Territories. Legislative Assembly. Annual Reports of the Department of Agriculture, 1900-5.

Nor'-West Farmer. 1881-93. Winnipeg, Manitoba.

O.A.C. Review. 1890-1907. Guelph, Ontario.

Ontario. Department of Agriculture. Annual Report of the Ontario Agricultural College, Sessional Papers, 1880, 1881.

Paterson, Elizabeth. 1957. Massey, McIntosh, Saunders: Pioneers in Agriculture. Clarke, Irwin, Toronto.

Pipe, Charles, V. 1914. Forage Plants and Their Culture. Macmillan, New York.

Public Archives of Canada, Ottawa
   Canada. Department of Agriculture. Organization and Personnel Files, RG17 1701 General; 170.1, Vol. 2812.
   Canada. Department of Agriculture. Records of the Minister, Deputy Minister, and Secretary, RG17 AI, Series I and II.

Public Service Monthly. 1914-19. Regina, Saskatchewan.

Rasmussen, Wayne D. 1960. Readings in the History of American Agriculture. Urban: University of Illinois Press, Urban.

Saskatchewan Archives, Regina
   McCall, David. 1973. "The Indian Head Experimental Farm and the Improvement of Agricultural Practices, 1887-1907," Student Essay.
   Saskatchewan. 1911-46. Department of Agriculture. Deputy Minister's Office Records.
   Saskatchewan. 1915-16. Department of Agriculture. Agricultural Representative Services Records.
   Saskatchewan. Department of Agriculture. Agricultural Societies' Records.
   Wheeler, Seager Edwin., Papers. Microfilm.

Saskatchewan Archives, Saskatoon
   Agricultural Society Records.
      1. Cabri Agricultural Society, 1917.
      2. Francis Agricultural Society, 1906-16.
      3. Kennedy Agricultural Society.
      4. Macrorie Agricultural Society, 1918-44.
      5. Saltcoates Agricultural Society, 1892-1956.
      6. Touchwood Agricultural Society, 1911-30.
      7. Weyburn Agricultural Society, 1908-65.
   W.R. Motherwell Papers.
   Richards, S. Manuscript and Diaries, Wadesa Area, Saskatchewan.
   Saskatchewan. 1911-50. Department of Agriculture. Field Crops Branch Records. 1911-50.

Saskatchewan. Department of Agriculture. 1910. Agricultural Bulletin No. 21, W.R. Motherwell, "Methods of Soil Cultivation Underlying Successful Grain Growing in the Province of Saskatchewan."
---. 1915-40 Annual Report, Sessional Papers.

Stephenson, James H. 1915. Traction Farming and Traction Engineering. Frederick Drake & Company, Chicago.

Turner, Allan R. 1958. "W.R. Motherwell and Agricultural Development in Saskatchewan," 1905-1918. Unpublished M.A. thesis, University of Saskatchewan.
---. "W.R. Motherwell: The Emergence of a Farm Leader," Saskatchewan History, Vol. 11, No. 3 (Autumn 1958), pp. 94-103.

---. "W.R. Motherwell and Agricultural Education," Saskatchewan History, Vol. 12, No. 3 (Autumn 1959).

University of Guelph, Guelph, Ontario. 1902-06. Office of the Registrar. Academic Transcript of John Bracken.

University of Saskatchewan. Saskatoon, Saskatchewan. 1909-10, 1910-11. President's Report.

Wheeler, Seager. 1919. Seager Wheeler's Book on Profitable Grain Growing. Grain Growers' Guide, Ltd., Winnipeg.

Wik, Reynold M. 1963. Steam Power on the American Farm. University of Pennsylvania Press, Philadelphia.

W.R. MOTHERWELL'S FARMING OPERATIONS

David Spector

216 Abstract
217 Introduction
220 Motherwell as a Homesteader, 1882-1904
    220 Early Training at the Ontario Agricultural College, Guelph
    222 Land Purchases
    223 Early Field Agriculture Experiments
    226 Mixed-Farming Efforts
229 The Ministerial Years
    229 Gardening Practices, 1905-18
    233 Field Husbandry Practices, 1905-18
    238 Mechanization at Lanark Place
    239 Animal Husbandry Practices, 1904-18
244 The Later Period, 1921-43
248 Conclusion
250 Endnotes
258 Bibliography

ABSTRACT

W.R. Motherwell's pivotal role as Saskatchewan Minister of Agriculture in the formative period of prairie dry-land agriculture was grounded in his own extensive experience as a farmer in the Abernethy District. A graduate of the Ontario Agricultural College at Guelph, he quickly established a reputation as a consistent prize winner at local fairs near his prairie homestead. Later, his empirical studies in the effects of summer fallowing on crop yields established his reputation as a progressive farmer. Yet Motherwell's approach combined traditionalist ways with the new methods. His reluctance to mechanize his own farming operations prompted future financial difficulties in the era of farm expansion in the 1920s. His farming operations, considered progressive in the early period, inevitably suffered from his appointment to the Saskatchewan cabinet in 1905, which diverted most of his energies to public life.

Submitted for publication 1978, by David Spector, Parks Canada, Prairie Region, Winnipeg.

INTRODUCTION

In 1882, William Richard Motherwell, the young son of a Lanark County, Ontario farmer, came West to try his luck in farming on the prairie dry belt. Behind him lay his native eastern Ontario, a region of small farms claimed from a forested and sub-humid wilderness. Ahead, a barren prairie with insufficient rainfall awaited the newcomer. Yet Motherwell remained undaunted. After all, he possessed the best agricultural training available in central Canada - a diploma from the Ontario Agricultural College in Guelph. Moreover, his performance as a student at the O.A.C. had been impressive - in virtually every course, he stood near the top of his class. After securing a homestead north of the Qu'Appelle Valley, an area that the railroad would not reach until 1904, Motherwell, like so many other pioneers, began his life's work of making the forebidding and unpredictable prairie dry land productive.

A person's early training influences his response to later challenges in life. Raised on a mixed farm in Ontario a young farmer was likely to raise livestock during his early homesteading years on the Prairies. If he attended classes at the O.A.C., the lectures and advice of his instructions inevitably led to the performance of agricultural chores in a prescribed manner. Frequently, however, many facets of the Southern Ontario experience proved inapplicable to the West. Then, the yound husbandman had to adapt his educational background to the altered reality. Practices such as fall ploughing and intensive cattle rearing in water-scarce districts could only lead to failure. Frequently, farmers without college training or a rural Southern Ontario upbringing coped more ably with the prairie environment than their better-educated Ontario counterparts.

It cannot be denied that the climatic peculiarities of the prairie dry belt presented a challenge to the best 19th-century agricultural experimentalists. At the Dominion Experimental Farms at Indian Head, Brandon and Ottawa, individuals such as Angus Mackay, Spencer A. Bedford, and William and Charles Saunders responded by devising farming techniques that were as productive as they were sophisticated. Concentrating on grain growing, the federally operated farms developed new hardy wheat varieties and refined ploughing, summer fallowing and cultivation methods. Ancillary to their main endeavours, they tested forage crops such as bromegrass and alfalfa and even paid some attention to horticulture and aboriculture. Farmers outside the experimental farm structure such as John Gunion Rutherford, William J. Rutherford, and F.W. Torrance devised suitable livestock-raising methods for the prairie environment. To succeed, prairie farmers needed to keep abreast of agricultural developments. Those farmers who took the effort to comprehend and implement the new techniques

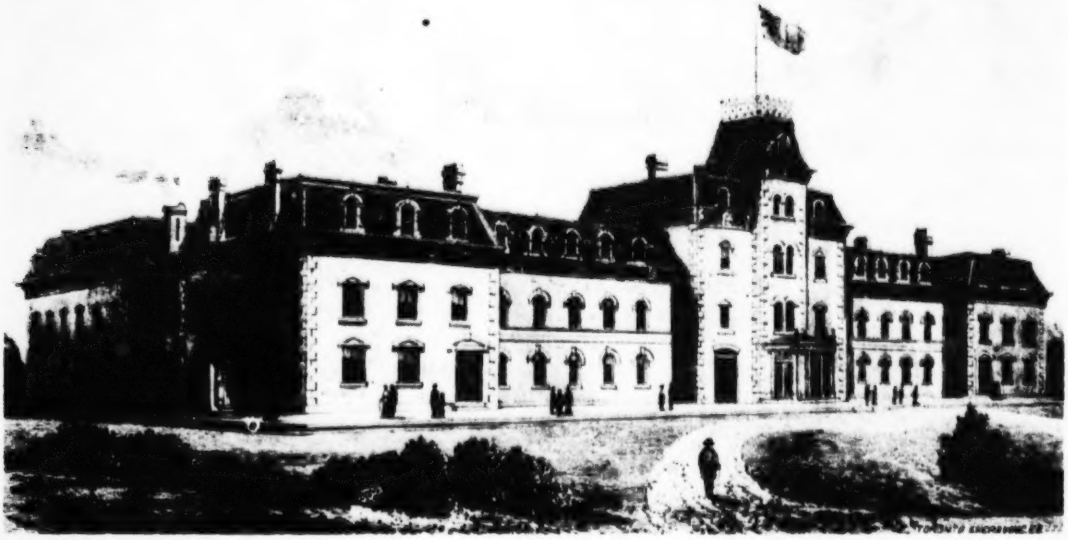

Figure 1. Ontario Agricultural College, Guelph, 1878. (Ontario, Sessional Papers, Report of the Ontario Agricultural College, 1878.)

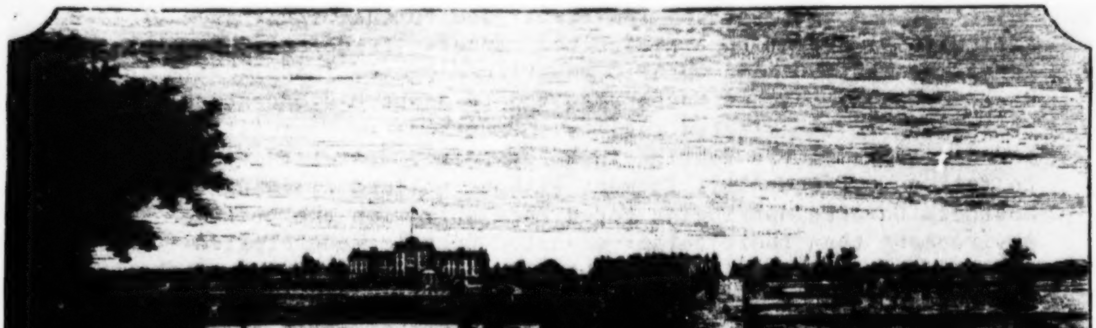

Figure 2. Part of the Ontario Agricultural College. (Ontario, Sessional Papers, Report of the Ontario Agricultural College, 1878.)

benefited from higher grain and forage crop yields, and fatter and healthier livestock. Traditionalists, on the other hand, could only expect a brief farming stint before the bailiff's ominous appearance.

Above all the farmer's operations had to be commercially viable. At stake was the survival of the homesteader and his family. The ingredients for commercial viability varied from district to district. In parkland regions of Central Saskatchewan, the danger of frost damage to Red Fyfe led to a preference for mixed farming. Transportation facilities could determine profitability. With lands close to the Canadian Pacific main line in Eastern Saskatchewan, farmers could obtain a maximum income from wheat growing. On the other hand, before the completion of a rail line to the north side of the Qu'Appelle Valley, a mixed-farming operation ensured early success. Once the transportation difficulties were overcome wheat stood as the farmers' natural choice. Labour costs constituted the third variable. Ideally the commercially astute farmer worked his fields alone while his wife tended a small garden that supplied household needs. Only at harvest time did he require a custom thresherman. The farmer that needed year-round labour quickly witnessed the erosion of his profit margin. Escalating labour costs brought about by manpower shortages transformed the hired hand into an expensive proposition by 1910 and an unwarranted luxury eight years later. In short, the ideal farmer carefully evaluated his climate, transportation facilities, and manpower requirements before opting for a particular line of husbandry.

An assessment of W.R. Motherwell's farming operations must invariably account for the influence of his Lanark County upbringing and O.A.C. training on his Abernethy endeavours. The extent to which he adopted modern field and animal husbandry techniques must also be considered. Above all, attention must be paid to the commercial viability of his farm.

A study of Motherwell's farming practices must take into account his political career and the fact that some of his undertakings may have been politically rather than agriculturally motivated. Abernethy district farmers viewed him as somewhat of a patriarch during his ministerial tenure. To maintain that exalted position Motherwell may have made decisions that proved agriculturally unsound. In short, Motherwell must be viewed as a farmer-politician.

MOTHERWELL AS A HOMESTEADER, 1882-1904

When Motherwell first set foot on the north side of the Qu'Appelle Valley, he decided that the gently undulating terrain bordering Pheasant Creek provided an ideal setting for re-creating the mixed-farming Arcadia of his Eastern Ontario youth. Without the luxury or immediate prospect of a railroad to transport his produce and deliver commercial foodstuffs, the temptation to concentrate his efforts on a particular line of husbandry was removed. Motherwell would become a complete farmer - self-reliant for his vegetables, dairy products, beef and bread. By astutely selling excess commodities, he would transform a frontier homestead into a thriving agricultural operation.

On the northern rim of the Qu'Appelle Valley during the 1880s, Motherwell's scheme was not only practical but profitable and would remain so until modern transportation transformed the Abernethy District into one of the province's leading wheat-growing areas. Stumbling across the technique of summer fallow by accident, he later learned the advantages of spring ploughing through careful personal observation and communication with Angus Mackay of Indian Head. Motherwell also mastered the cropping techniques so necessary to provide sufficient plant moisture in a region with sparse precipitation. Content with rudimentary housing and outbuildings, he concentrated his efforts on raising small quantities of wheat and oats, cultivating vegetables, and raising the common Shorthorn mongrel for its milk and beef. Yet the seeds of later failure were sown by Motherwell's initial triumph. From his pioneering experience Motherwell concluded that the future of the Northwest lay in Ontario-style farming - an erroneous assumption. To prove his point, in 1897 he began the construction of Lanark Place, a farmstead with all the lavishness of a country estate, that registered consistent financial losses.

Early Training at the Ontario Agricultural College, Guelph

The agricultural training Motherwell received at the Ontario Agricultural College was unsophisticated and not generally applicable to prairie conditions. To enter, a student required only basic literacy. If a student did not possess a Certificate of High School Entry the successful completion of a literacy test sufficed. Once installed for a two-year period in the college's mansard-roofed confines, the student's only sources of agricultural information were the daily professorial lectures and a tiny reading room holding about

400 books and several farm periodicals.[1] An 1881 Commission of Agriculture established by the Ontario government complained that the lack of standardized textbooks limited the standard of education at this institution.[2] Moreover, the curriculum over-stressed animal husbandry at the expense of field agriculture. The preponderance of livestock-related courses led one of Motherwell's contemporaries to remark that one "could no more leave the College after [a two] years' course, and farm a thousand acres, than fly to the moon. They [only] teach you to tend stock, and to judge stock here."[3] A mere grounding in the principles of livestock rearing hardly constituted a sufficient education for the prospective prairie homesteader.

Course offerings of the Ontario Agricultural College for 1880-81 can be divided into three categories, including background subjects as well as those concentrating on field agriculture and animal husbandry. Encompassing such subjects as chemistry, botany and arithmetic, O.A.C. background courses demanded the same skills of students as comparative subjects offered by the province's high school. While enrolled in Guelph during 1880-81, Motherwell was required to distinguish between atoms and molecules and list the properties of atmospheric elements. The facts that he memorized constituted a mere repetition of his secondary school chemistry courses in Perth. James Mills, Motherwell's botany instructor at the Ontario Agricultural College, geared his courses to the same ends as the secondary school system. Motherwell acquired knowledge of cell reproduction and the functions of various parts of a flower, information to which he had been previously exposed. Lastly, O.A.C. arithmetic offered little challenge to the future homesteader. High school square roots, percentages, and double-entry bookkeeping indeed constituted a tougher fare than O.A.C. adding, subtracting, dividing, multiplying and simple farm bookkeeping.[4] Thus, little surprise can be expressed at Motherwell's standing - first in arithmetic, bookkeeping and second in inorganic chemistry in 1880, and first in mathematics, second in agricultural chemistry and natural science in 1881.[5] Motherwell had merely duplicated his secondary school effort.

Motherwell's contemporary was indeed justified when he lamented the absence of intensive field husbandry training. Administrators chose to offer only one half course each year on the subject - "Agriculture: The Field." During his first year in Guelph Motherwell only learned to differentiate productive from unproductive wheat varieties, identify suitable fodder crops for Ontario, and rationalize Ontario crop-rotation patterns. His second-year half course merely repeated the first year's work.[6] This basic training proved inadequate for Motherwell's encounter with the prairie climate. He left the college without knowledge of suitable prairie grain varieties, appropriate times for breaking, ploughing, seeding, and threshing nor any conception of the need for soil-moisture preservation. Only by trial and error could the young homesteader hope to mature crops successfully in his new surroundings.

On the other hand, animal husbandry courses were unusually thorough. During his stay in Guelph, Motherwell successfully completed four full and two half courses on livestock rearing. The half course, "Agriculture: Livestock" introduced the topic. First-year lectures on breed selection and ideal draft horse qualities were superseded by the dissemination of knowledge on desirable characteristics of sheep. In first year practical exams staged in the O.A.C. barn, Motherwell pointed out the strengths and weaknesses in sample Shorthorn bulls, and Ayrshire cows. The following year, like other O.A.C. students, he described steer defects. A full-length course, Materia Medica concentrated on livestock disease amelioratives. E.A.A. Grange, Veterinary Surgeon, summoned his full knowledge of veterinary medicine in lecturing upon the therapeutic value of arsenic, carbolic acid, castor oil, belladonna, oil of turpentine and, above all, opium. The study of veterinary anatomy and veterinary science completed the livestock portion of the programme. The former, a first-year offering, provided Motherwell with a detailed knowledge of the main organs, glands, and muscles of cattle, sheep, horses and swine. The latter demanded that the student possess the ability to identify and understand the nature of animal disorders. When Motherwell arrived in the North-West Territories he was well-versed on all known aspects of 19th-century animal husbandry.

Motherwell's education at the Ontario Agricultural College did not rank with the best on the continent. Before the Ontario Department of Agriculture lengthened the college's program to four years in 1902, few pioneers in scientific agriculture graduated from that insitution. During 1881 American schools such as the Pennsylvania College of Agriculture and the College of Agriculture at Cornell University offered farmers' sons more thorough training. Probably the most complete grounding in the subject was provided by the latter institution. High entry requirements consisting of the successful passage of examinations in English grammar, geography, arithmetic, and algebra along with a freshman year devoted to the basic sciences ensured a high degree of literacy among students. Second- and third-year courses in agricultural chemistry, zoology, botany, entomology and physics provided the student with a sound theoretical knowledge of the science. Practical courses during the second and third years such as entomology, agricultural botany, vegetable physiology, arboriculture, landscape gardening, and veterinary science transformed the student into a knowledgeable farmer. A fourth year with intensive instruction in practical agriculture completed the curriculum.[7] Similar in content stood the programme of the Pennsylvania institution. Devoting two years to the basic sciences, its' instructors inculcated students with courses similar to the Ithaca, New York school during the third and fourth years.[8] After two years' attendance at the O.A.C., Motherwell's training could not equal the intensity and depth of the two leading American agricultural colleges - his training remained that of the technical school.

Land Purchases

In 1883 Motherwell claimed his original homestead, the northeast quarter of Section 14, Township 20, Range 11, West of the Second

Meridian and commenced the process of acquiring lands for his farming operations. At first Motherwell's attempts to expand his landholdings were thwarted. He failed to negotiate in 1885 purchase of NW12-20 - 11W2 in order to re-establish his homestead on the north side of Pheasant Creek.[9] Spurned once, he now embarked on a path of rapid land acquisition. By 1890 the pre-emption quarter to the immediate south of his homestead was safely in his hands. Eight years later he cast envious eyes on the northeast quarter of Number 11, a school section. Despite threats of prosecution from the Department of the Interior, Motherwell cropped this land parcel illegally well before he had had any opportunity of purchasing it at a public auction under the terms of the Dominion Lands Act.[10] The federal government, however, did not prosecute and indeed, a 1906 receipt indicates that Motherwell paid the Department of the Interior $219.81 principal plus $180.19 interest.[11] This, therefore, lends credence to the possibility that the future Agriculture Commissioner secured the quarter section shortly after the departmental threat. As his homesteading period came to a close in 1904, Motherwell could be placed among the Abernethy district's major landholders. Besides securing frontage south of Pheasant Creek, he now owned two quarter-sections north of his farm. His holdings now totalled almost 960 acres.[12]

Motherwell did not confine his land purchases to the Abernethy district. Before 1909 he possessed extensive holdings throughout the province. Succumbing to the land speculation enthusiasm so prevalent during the early 1900s, Motherwell could boast of sections near Markinch, Loon Creek and Davidson in 1906. Three years later he was speculating in virgin farmlands in the Outlook District.[13] He even possessed miscellaneous properties such as a town lot in Fort Qu'Appelle.[14] In all likelihood these lands never witnessed the blade of Motherwell's plough, as he limited his croppings to Abernethy.

Early Field Agriculture Experiments

The farming career of the Abernethy patriarch evolved from decisions made in 1883. During a year of nation-wide recession Motherwell decided that he would become a mixed farmer. Since mixed farming was the only type of agriculture he knew, the decision was logical. Moreover, it made good sense. Self-sufficiency in foodstuffs would ensure his physical survival during the long prairie winter when the trek across the 500-foot-deep Qu'Appelle Valley endangered life and limb. Until the railroad arrived, Motherwell's isolation from transportation facilities would compel him to seed crops that would be both practical and profitable. Like countless other homesteaders Motherwell probably began his operations with a team of oxen, a plough, harrow, and mower, as well as a cow and two pigs - a total investment under $300.[15]

Little information remains on Motherwell's early cropping patterns. What is known is that Motherwell seeded 28 acres in 1884 and

65 acres four years later.[16] With each passing year he probably seeded more and more of the rich prairie soil. One can only speculate on the type of seed inserted into the ground by Motherwell's drill. At first he probably cultivated Red Fyfe wheat and Prize Cluster oats, two varieties Angus Mackay declared suitable for prairie conditions.[17] The necessity of having to haul his grain across the Qu'Appelle Valley to Indian Head for a mere return of $20 per wagon load soon led the Abernethan to consider the cultivation of more profitable crops. In 1894, he converted his wheat fields to bromegrass - a fodder with a supposedly highly valuable seed. For each wagon-load of brome seed Motherwell could secure $200.[18] In this fashion he had attempted to maximize his profits.

Within a decade after seeding his first wheat crop Motherwell possessed the rudimentary dry-farming skills so necessary for economic survival. Like other prairie farmers he failed to practice summer fallowing before 1886. Then, he accidently discovered the value of the fallow. After leasing his horses to draymen who were hauling supplies to the Canadian Expeditionary Force quelling the Riel Rebellion, Motherwell did not possess the animal power to seed his entire acreage. When weeds appeared on his unseeded land in July 1885, he used his recently returned horses to plough the infested field. The following year the summer-fallowed plot produced his only crop in the midst of a regional drought, a yield of 25-30 bushels per acre.[19]

Motherwell soon learned that fall ploughing and seeding stubbled land proved disastrous. By ploughing in the autumn, Motherwell witnessed crop failure in 1886 and 1889. Finally, he decided to alter his procedures. Using spring tillage in 1890, the same year that Angus Mackay of Indian Head took the same step, he undoubtedly concurred in the Superintendent's conclusion that the shrunken-wheat crop of earlier years had been eliminated.[20] Even more detrimental was Motherwell's practice of seeding unploughed stubble with wheat. Apparently he "sowed stubbled land without either burning or discing, but it was when the land was new and had very few weeds in it."[21] According to Mackay, the best yield Motherwell could expect to achieve was 8-15 bushels per acre, a far cry from the 30-40 bushels attainable on summer-fallowed land. The lack of moisture proved the culprit; stubble possessed insufficient moisture to mature a wheat crop during the hot dry prairie summer.[22] By abandoning the practice of seeding stubble, and adopting summer fallowing and spring ploughing, Motherwell had mastered late 19th-century wheat-growing technology.

Motherwell's contemporaries depicted the Abernethy farmer's decision to grow bromegrass in 1894 as ingenious and innovative.[23] Despite the fact that it was neither, it nevertheless represented a wise business decision. No longer would Motherwell have to haul numerous wagon-loads of wheat across the valley to Indian Head as one cart of brome seed would secure a sizeable return. Moreover, the straw made excellent livestock feed.[24] Yet Motherwell cannot be construed as a pioneer since Angus Mackay had experimented with the grass since 1892.

Contrary to the rather fanciful statement in *Prairie Farm & Home* that Motherwell imported his bromegrass from Austria, it appears more likely that he accepted Mackay's 1894 offer of a free shipment of the seed. After the acquisition of several of Mackay's 335 one-pound bags of *Bromus Intermis*, Motherwell probably followed the latter's instructions for seeding and cultivation.[25] He recommended that farmers sow 15-18 pounds seed per acre to a depth of 4 inches on summer fallowed land in April or May. As soon as weeds made their appearance the farmer clipped them with his mower. If the farmer cultivated brome for its seed, he could swath his acreage with a binder one year after planting. Cut, tied and stooked like other grain crops it could be threshed after a week of maturing.[26] Since Motherwell continued to seed bromegrass throughout the 1890s and up to the Great War, it appears likely that his success was derived from careful consideration of Mackay's methods.

Gardening supplemented Motherwell's grain and bromegrass cultivation. Geared not only to meeting household needs, his efforts provided profits from the sale of excess vegetables. According to Motherwell's daughter, Alma Mackenzie, her father discovered the Fort Qu'Appelle market for the produce from his substantial garden.[27] It is uncertain what Motherwell cultivated. His education at the Ontario Agricultural College offers no clue since his second-year course in horticulture dealt only with theoretical and greenhouse-related topics.[28] But Angus Mackay at nearby Indian Head had successfully grown vegetables under prairie conditions and it is possible that Motherwell emulated him. If he did, he seeded beans, table carrots, onions and potatoes, and tomatoes. Planted during the second week in May, beans could be harvested in early August. With an early April seeding, onions would be ready for use by July. Although tomatoes would not mature before the first autumn frost they could be ripened indoors. Cultivated on fallowed land, harrowed upon first appearance, and divided into hills with careful ploughing, potatoes could expect to yield substantial returns.[29] If Motherwell followed Mackay's advice on crop selection and seeding dates, he probably had little to fear from climatic vagaries.

Before 1897 Motherwell practised only one of the two suggested horticultural techniques. When summer-fallowed land was found to preserve soil moisture in 1886, Motherwell probably increased his vegetable yield by setting aside a portion of his garden for that purpose.[30] On the other hand, he failed to plant a windbreak or shelterbelt to shield his garden from the cold winds of May and hot winds of July, a construct Mackay so ardently advocated.[31] Only in 1897 with the erection of the present farmstead did Motherwell rectify the situation. For more than a decade he had carefully fallowed his garden plot only to place his vegetables at the mercy of the relentless winds.

The seasons determined Motherwell's field husbandry activities. In the spring he ploughed and seeded his fields and planted his garden. As the days became warmer Motherwell's thoughts turned to summer operations and perhaps to the anticipated harvest. Young wheat and oat seedlings required care. Hitching his animals to a common harrow and later a disc, the young Abernethan eliminated weeds and prepared his fertile soil for the reception of life-supporting June rains. His summer fallow received considerable attention. Periodical ploughing counteracted weed infestation and maintained moisture receptiveness. In early August, the bromegrass crop stood foremost in Motherwell's mind. He cut this succulent feed with a mower, a hand flail was probably used for the separation of the seed from the hay. Motherwell stored the latter for livestock feed.[32]

In late August, while admiring his ripe grain fields, he made preparations for the harvest. Before the first frost, his grain would be cut and stooked neatly in rows. Six or seven farmers would form a co-op and place a threshing machine and about 20 horses at the company's disposal. Hitched together and proceeding in a circle horses powered the grain separator. By December all district farms had witnessed the orderly excitement of massed horsepower and the attendant social functions of the harvest.[33] Only in 1894 was the procedure broken when Fred Grey, an owner of a portable steam engine, threshed in the Balcarres and Abernethy districts. He did this because of a poor crop at his Indian Head base.[34] After the harvest Motherwell could contemplate the following year's operations.

Motherwell's yields during his homesteading years were substantial. The 1880s generally provided him with fair returns except in 1886 and 1889. During the last decade of the 19th century only 1894 witnessed a drought. Along with his neighbours, Motherwell harvested satisfactory quantities of wheat and oats in the moisture-abundant years of 1890-93 and during the concluding years of the century.[35] Like other husbandmen, his success demonstrated that he had mastered the fundamentals of dry-farming.

Mixed-Farming Efforts

At the height of his political career Motherwell wrote that he "devoted considerable attention to stock raising and butter making during the 10 years of [his] pioneer experience and...can attribute to that move [his] safe and substantial progress in farming operations at a time when things looked pretty blue and were almost at a standstill."[36] Indeed, during his homesteading years he raised the whole range of stock expected of a mixed farmer - beef and dairy cattle and sheep. Moreover, he possessed a team of horses for his field-husbandry endeavours. Despite the fact that his stable was primitive and his stock anything but purebred, Motherwell succeeded in his animal-husbandry operations. The 1897 erection of the stone house at Lanark Place epitomized Motherwell's success.

To ascertain the extent of Motherwell's efforts to raise beef and milch cattle the researcher can only rely upon scattered references. In his correspondence Motherwell admits that cattle raising formed an integral part of his operations along with butter making.[37] Selwyn Carrington, a former Parks Canada historian, discovered that Motherwell received awards for the best Durham bull of any age and the best herd (one bull and three cows) entered at agricultural fairs at Qu'Appelle, South Qu'Appelle, and Indian Head in 1888.[38] Since the name Durham denotes Shorthorn stock and since the Shorthorn was a dual-purpose beast capable of providing both milk and beef,[39] we can proceed on the assumption that Motherwell raised this variety.

Motherwell's early farming operations cannot in any way be construed as sophisticated, although this is understandable, given his status as a homesteader of limited resources. Utilizing a log barn as a cattle shelter he had no place to store his animal fodder. Frequently his stable roof served as a convenient location for stacking hay where it could remain untouched until rationed to his Shorthorns.[40] The quality of Motherwell's stock proved as rude as his barn was primitive. During the entire homesteading period he never possessed purebred Shorthorn cows or bulls.[41] Moreover, he did not belong to the local cattle breeders association - an organization patronized by such prominent contemporaries as J.G. Rutherford, S.A. Bedford and Angus Mackay.[42] Motherwell's lack of purebred cows can be excused. Mackay pointed out that feeding purebred cows for market was unprofitable, but added that farmers should nonetheless strive for high quality animals with sound bone and muscle conformation.[43] Possibly, a more serious error on Motherwell's part lay in his failure to procure a purebred bull. Throughout the final two decades of the 19th century agricultural journals repeatedly warned that only purebred sires could impregnate their female recipients with the hardiness necessary to survive the prairie winter and the ability to retain sufficient beef to provide farmers with satisfactory monetary returns.[44] At the same time, he may have rented other farmers' bulls to service his cows.

Despite these shortcomings he achieved some success in cattle rearing. The returns he secured from milk and beef can probably be attributed to his use of bromegrass as a fodder. If Motherwell pastured his Shorthorns on brome, his animals were given a head start of several weeks over those pastured on domestic grasses. This came as a result of the import's faster growth following the evaporation of the last winter snow.[45] Even if brome was grown for seed, the hay was palatable to the livestock. A leading agriculturalist described the forage as being of fair feeding value.[46] Thus, by using brome as a feed Motherwell probably negated some of the ill-effects of questionable cattle selection and primitive housing.

Motherwell also raised sheep and horses. For a brief period during the 1880s he owned a small flock of sheep of an unspecified variety. The presence of coyotes and the lack of a suitable market for wool made this endeavour impractical and unprofitable.[47] A quick exit from this activity followed.

On the other hand, horses not only posed fewer problems to the stock grower but were necessary to pull the homesteader's farm implements. From Motherwell's small beginning he eagerly acquired draft animals. Purebred horses constituted an unwarranted luxury, and it is unlikely that Motherwell owned such animals. What he needed was a team of horses, three or four in number and by 1885 he had realized this goal.[48] A dearth of information on Motherwell's horse-raising activities from 1886 to his tenure as Commissioner of Agriculture only allows us to speculate on his activities during the interregnum. His preference for Clydesdales in the 1920s probably took root during the previous century. Since he failed to procure purebred mares and stallions in later years when he could afford the capital outlay, there is little reason to believe that he owned high quality horses in earlier years. We can only be certain that he increased his horsepower as his farming operations expanded. By raising sheep and horses in addition to cattle, Motherwell had eagerly engaged in mixed farming during his period as a homesteader.

Despite many shortcomings Motherwell's early mixed-farming operations had been successful. The young homesteader had come West and absorbed the fundamentals of dry farming through trial and error. Through his efforts a tract of windswept prairie grass had been transformed into a life-sustaining garden and grain field. Even his livestock endeavours had been worthwhile. Errors in Shorthorn stock selection had been partially compensated by his decision to feed his animals brome hay. As well, Motherwell had acquired the regular complement of horses to power his implements. By 1897, through his mixed-farming endeavours Motherwell had become so prosperous that he began work on a new farmstead - Lanark Place.

Motherwell's faith in the efficacy of Ontario-style mixed farming or the Canadian Plains was misplaced. By opting for an oversized garden and lavishly treed campus designed more for decoration than agriculture, Motherwell had created a constant demand for labour that would negate any profits he could hope to realize. Moreoever, his early reluctance to cultivate wheat became a phobia. Even the completion of a railroad line past Abernethy which ended the long trek to the Indian Head grain elevator failed to convince Motherwell to cultivate Red Fyfe or Preston. While his neighbours would adopt wheat as their staple crop, Motherwell remained true to his Ontario origins by seeding bromegrass and oats.[49] In the view of another Parks Canada historian, the farm became a self-defeating proposition when the new farmstead became operational.[50] Ontario-style mixed farming had become Motherwell's panacea.

THE MINISTERIAL YEARS

Isolation became just a memory for farmers residing north of the Qu'Appelle Valley after the completion of the Pheasant Hills Branch Line of the Canadian Pacific Railroad in 1905. From Lipton, Saskatchewan, the trackage led southeast to a terminus at Kirkella, a siding midway between Moosomin and Elkhorn.[1] With the availability of grain-loading facilities at Lemberg, Abernethy and Balcarres, farmers no longer faced the perils of late autumn travel across the Qu'Appelle Valley to grain elevators along the C.P.R. main line. In ever-increasing numbers they turned to wheat growing, a line of field husbandry that was both profitable and practical. Wheat, of course, had been a popular crop before the arrival of the railroad. Annual Reports of the North-West Territories' Department of Agriculture indicate that farmers cultivated more wheat than any other grain before 1905. The inclusion of the north side of the valley only as an adjunct to farmlands along the C.P.R. main line tends to downplay the importance of wheat growing to the early Abernethy District economy.[2] But with prevailing high prices, wheat growing in the vicinity of Motherwell's farm did assume a greater importance than that of any other crop after 1904.[3] However, Motherwell failed to utilize the new transportation facilities or partake in the cash bonanza that enriched his peers. He clung to a cropping pattern that differed markedly from his neighbours.

Motherwell's farm operations were neither progressive nor profitable. In an attempt to recreate a portion of Eastern Ontario on the bald prairie, he worked on a farm that stood out from his neighbours' in its sheer costliness. When considered as a whole his operations over-stressed horticulture and aboriculture at the expense of field husbandry. Even his fields bore more resemblance to Ontario than to dry-belt economic realities; oats, bromegrass and rye, the first two crops useful only as animal fodder, could hardly provide the income of a human staple food such as wheat. Poor animal husbandry practices further negated the viability of his farm. He constructed a lavish barn only to house inferior cattle and horses. Moreover, his livestock were reared only for household consumption and not for the abattoir. Motherwell's farm indeed stood as a showcase, but only one where visitors could view unprofitable farming practices.

Gardening Practices, 1905-18

With the completion of his new farmstead Motherwell duplicated his earlier horticultural endeavours, but this time on a grand scale. His garden measured 250 x 125 feet, a size 40 per cent beyond the half-acre plot that experts considered a farmer capable of working.[4] Such a huge garden necessitated hired help. Therefore, Motherwell dispersed funds he had earned as Commissioner of Agriculture to retain the services of a full-time gardener. In addition to tending the grounds, this man's responsibilities included the seeding, cultivating and harvesting of the vegetables and small fruits grown on the strip of land running along the eastern edge of his acreage.[5] Workmen including Major McFadyen, Jack Wejer and Scott Mulligan undertook the necessary tasks so the Motherwell family and their numerous guests could consume the entire harvest from the immaculately kept plot. Motherwell's expenditures, however, represented pure overhead. Unlike in his pioneer years, Motherwell did not retain the surplus from his crops. Instead, he paid gardeners salaries ranging from $250 to $350 in 1907 to sums 70 per cent higher ten years later just to tend to his horticultural needs.[6] From 1907 to 1917 Motherwell spent between 5 and 10 per cent of his annual $5000 ministerial income[7] on his garden upkeep alone. Jack Bittner, Motherwell's former neighbour, asserted quite accurately in a recent interview that the former Agricultural Commissioner gardened only to show off his capabilities.[8]

As a horticulturalist Motherwell practised contemporary but not particularly innovative cultivation techniques. A 1907 invoice from the Steele-Briggs Seed Company of Winnipeg indicates that he planted sweet peas, beans, cauliflower, and onions during that year.[9] Further correspondence suggests that cucumbers and potatoes matured in his garden.[10] In a Parks Canada report, Ian Clarke adds that Motherwell took pride in his rhubarb, sweet corn and celery, crops that he probably seeded until 1920 along with his standard array of vegetables. Seeded on Motherwell's specialty - summer-fallowed land - the gardener worked the crops with a Planet Junior Cultivator, a tool highly recommended by leading horticulturalists.[11] But the garden did possess shortcomings. Clarke mentions that gardeners planted rows in a north-south direction, a practice that could prove detrimental. While "latitudinal vegetable rows planted in ascending order could receive full benefit from the sun while shielding the soil against its parching action...longitudinal rows left the soil susceptible to accelerated evaporation."[12] Moreover, Motherwell's practice of summer fallowing half his garden annually became a necessity since he did not bother to water it.[13] Without irrigation, only the summer fallow would preserve sufficient moisture to mature vegetables in the dry belt, an axiom that Motherwell realized during the 1880s. What surprises one most is that Motherwell refused to irrigate his garden even after he could secure sufficient water from his dugout or his frontage on Pheasant Creek.[14] In 1956 when the Western Canadian Society for Horticulture prepared a history to honour pioneers in scientific gardening, Motherwell's name was conspicuously absent.[15] Evidently, Angus Mackay, Spencer A. Bedford and Seager Wheeler had made greater contributions.

According to Motherwell's daughter, her father received instructions and encouragement for planting fruit trees and shrubs from

Angus Mackay.[16] Therefore, it is likely that the Agriculture Commissioner also accepted the Superintendent's advice for cultivating vegetables. MacKay's advice and that of his equally distinguished Brandon colleague, S.A. Bedford, were synthesized in a 1913 pamphlet written by F.W. Brodrick, Professor of Horticulture and Forestry at the Manitoba Agricultural College.[17] In this tract Brodrick suggested seeding and cultivating techniques that Motherwell probably followed.

Celery was a most difficult crop to cultivate and Motherwell only succeeded by following written instructions carefully. In line with Brodrick's suggestions celery was seeded in a trench[18] probably 14 inches wide, 18 inches deep with a 6-inch manure base topped by an equal amount of soil. Spaced six inches apart, the seedlings possessed the resources on which to mature.

Cucumbers and tomatoes also required hot beds on which to begin their growth.[19] Seeded in the hot bed in early April, both varieties were transplanted at the beginning of June.[20] United States pamphlets of the same period further suggested that the gardener should stake tomato plants and that cucumbers should be planted in hills 4 feet apart.[21]

Motherwell's main crop, potatoes, received Brodrick's trained attention. The MAC instructor warned horticulturalists to plant potatoes only on summer fallow. Seeded in rows 30 inches apart and about 4 inches deep during the third week in May, advice in which U.S. authorities concurred,[22] Motherwell could expect to obtain high yields.[23] The fact that Motherwell registered annual surpluses of potatoes and large quantities of celery and cucumbers demonstrates that he heeded the advice of experimentalists and academics.

Experts offered advice on cultivating beans, onions, sweet corn and rhubarb. Brodrick warned gardeners that beans were not a sure crop unless planted after June 15th. United States authorities added that horticulturalists should sow the plants in rows 20 inches apart with a space of 4 inches separating plants from one another.[24] Onions were equally simple to cultivate insofar as an early spring seeding one inch deep with a five-inch space between plants could produce early results. On the other hand, sweet corn required a more concentrated effort. After June 1st, gardeners sowed the seed in rows three feet away from one another. Thorough cultivation with a wheel hoe ensured plant access to moisture sources.[25]

Of all the crops Motherwell grew, rhubarb needed the greatest initial attention. The horticulturalist could only expect to obtain a small seedling after one year's growth. During the second year the farmer transplanted his rhubarb into a manure-laden pit 12-14 inches deep. Each succeeding spring he removed the plant's foliage while in the autumn he applied a heavy coat of manure to guard against frosts.[26] Photographs of the Motherwell farmstead as well as the reminiscences of Motherwell's daughter indicated that Motherwell harvested an abundance of beans, onions, corn and rhubarb. It therefore seems likely that he applied the appropriate seeding and cultivating techniques.

Motherwell selected a diversity of small fruits for cultivation that were similar in scope to his variety of vegetables. Opposite the house and adjacent to the implement shed strands of watermelons, choke cherries, saskatoons, currants, gooseberries, raspberries and strawberries annually bore fruit. Acquired from Angus Mackay, Motherwell planted and cultivated his fruits according to the principles pioneered by federal government experimentalists.[27] The extent of his annual harvest points to the conclusion that his gardener carefully followed experimental farm advice.

Most small fruits (with the exception of currants) could be grown easily and with few difficulties. Planted during autumn, cuts taken from gooseberries, raspberries and currants developed stems and foliage and bore fruit the following summer. Shallow cultivation at regular intervals loosened the soil surrounding individual plants and thus permitted them to reach much-needed moisture sources. Of course horticulturalists had to consider each variety's peculiarities. Gooseberries, for instance tended to produce a large useless stem system that needed periodical pruning.[28] At the end of each season raspberry bushes required cutting about a foot above ground level.[29] A winter straw covering protected all plants from damage caused by alternate thawing and freezing.[30]

Only strawberry and currant culture presented challenges to the gardener. Unlike the other fruits, strawberry cuts were planted in the spring. After a brief period of deep tillage followed by shallow cultivation the farmer could expect to harvest a sizeable crop. While other fruits yielded perennial harvests, strawberry plants could only produce two crops at the best.[31] Motherwell's daughter recorded that her father grew strawberries of such proportion that they were eaten in porridge bowls.[32]

It is doubtful whether Motherwell achieved such success with currants. In 1906, 1908, 1909 and 1911 Angus Mackay reported that currant bushes on the experimental farm at Indian Head fell victim to the currant maggot.[33] Alma Mackenzie also stated that the same parasite destroyed Motherwell's crops on at least one occasion.[34] W.T. Macoun described the havoc created by the pest as the following:

> These maggots come to full growth just as the berries are about to ripen, causing them to fall from the bushes, when the insects leave them and burrow into the ground to pupate. Attached fruit is rendered useless by the presence of the maggots inside the berries; and frequently it is not until the fruit is cooked that white maggots can be detected.[35]

With no real remedy to rectify the situation, Angus Mackay's successor at Indian Head declared that currants were unsuitable for the Prairies.[36] It is unknown whether Motherwell concurred in this assessment.

Alma Mackenzie's reminiscences point to the conclusion that her father was, in fact, a meticulous grower of small fruits. Indeed, he cultivated strawberries, raspberries, and gooseberries on such a scale that he had sufficient supplies to feed his large household. It can be speculated that by following the advice of Mackay and his colleagues, Motherwell was ensured of large yields. Yet Motherwell did not attain recognition as an experimentalist. An apple breeder like Seager Wheeler probably made a greater contribution to prairie horticulture.[37]

Field Husbandry Practices, 1905-18

Motherwell's field husbandry practices were probably unique to the region north of the Qu'Appelle Valley. While Saskatchewan farmers in general and Motherwell's neighbours in particular devoted the greater portion of their acreages to wheat, Motherwell seeded the crops of his Perth County boyhood home. Described by John Bracken as "practically the only concentrate fed to horses in the West," oats became his principal staple and replaced the more profitable wheat. Two other forage crops, bromegrass and winter rye, completed his selection. Motherwell's farm income was derived from three fodders.

Since only fragments of Motherwell's farm correspondence remain we can only determine the cropping patterns he adopted by combining facts with speculation. Before 1914 oats probably covered a greater portion of his acreage than either brome or winter rye. The 1908 figure of 100-150 acres of oats probably constitutes his average 1904-14 seeding.[38] Bromegrass and winter rye occupied lesser, but still substantial acreages before 1914. In 1909 and 1912 Motherwell reported that he harvested 60 acres of brome.[39] The 60-acre plot also appears as a reasonable size for the Agriculture Commissioner's 1908-14 winter rye seeding. After Angus Mackay proclaimed rye suitable for prairie cultivation in 1907, it seems likely that Motherwell eagerly took up this line of field agriculture.[40] Before the outbreak of the World War I, Motherwell cultivated at least 340 acres of his large Abernethy holdings and practised regular summer fallowing.

Discoveries by agriculturalists at Dominion Experimental Farms led Motherwell to adopt a comprehensive crop rotation pattern. In 1912 James Murray, Superintendent of the Brandon Experimental Farm, warned that constant grain cropping resulted in gradual depletion of soil nutrients.[41] Moreover, relentless ploughing and harrowing destroyed the soil fibre and allowed prairie winds to disperse a farmer's profit-producing loam.[42] To preserve the soil quality Motherwell opted for a unique five-year rotation pattern that prevented soil drifting, but failed to fully replenish depleted nutrients. After 1914 he divided his 480 cultivated acres into four plots containing 120 acres. His cropping pattern consisted of one season each of fall rye, oats, and bromegrass, and a summer fallow followed.[43] Similar only to a hay, pasture, pasture, oats and barley pattern (substituting a summer fallow for barley) completed by G.H. Hutton of the Lacombe, Alberta Experimental Farm in 1915, the cropping left Motherwell with a firm, yet nutrient-depleted soil.[44] By 1920 Motherwell could take pride in possessing the finest soil, but probably the least profitable cropping pattern in his district.

Motherwell's cropping pattern was geared more to the conditions of Perth County, Ontario, than Saskatchewan. From the establishment of the province to the end of the World War I, Saskatchewan farmers grew more wheat than any other crop. A similar situation existed in the region encompassing the Abernethy District. On the verdant terrain extending 20 miles both north and south of the Qu'Appelle River, farmers favoured wheat over oats by a ratio of three to one.[45] The latter figure is significant because it may also represent a rotation pattern. On the fertile loams bordering the valley, farmers could have seeded three wheat crops, and one of oats before fallowing. Motherwell's neighbours followed the trend. Jack Bittner's parents engaged in extensive wheat growing. Englehart Steuck, and his brothers Conrad and John did likewise.[46] Perth County farmers, on the other hand, selected oats and hay as their principal crops. During 1904-19 Perth County farmers devoted five- sixths of their cultivated land to equal portions of oats and hay (which may have consisted of bromegrass).[47] Each parcel of 650 seeded acres out of a 1000 total encompassed 213-245 acres of oats and 189-217 acres of pasture grass during 1904-14.[48] Like Motherwell, Perth County farmers cultivated scarcely any wheat. By concentrating on oats and forages such as brome and rye, Motherwell duplicated the efforts of husbandmen near his childhood home.

It was Motherwell's considered belief that oats took to the prairie soil north of the Qu'Appelle River more readily than its more popular counterpart. Unfortunately his reasoning was faulty. While farmers could expect a yield of at least 45 bushels per acre for oats compared with 20-25 for wheat, farmers cultivating the latter secured returns about three times higher.[49] Other farmers did not share Motherwell's concern that wheat was unsuited to the Abernethy District and difficult to cultivate. Ralph Steuck, whose father Conrad was a pioneer in the area, declared that Motherwell's farm consisted of wheat land.[50] Another farmer, Jack Bittner, could not comprehend his illustrious neighbour's reluctance to grow wheat.[51] Moreover, the facts gathered by Motherwell's own officials destroyed the credence of the minister's hypothesis that early frosts made wheat cultivation impractical. A particularly detailed 1912 Annual Report of the Saskatchewan Department of Agriculture revealed that the 1911 and 1912 wheat crops in Motherwell's district were seeded and harvested earlier than oats.[52] Wheat was not only harvested earlier but proved less susceptible to frost. The same report mentioned that 5.78 per cent of all oats acreage succumbed to frost in 1912 in the southeastern part of the province while the figure stood at 1.49 per cent for wheat.[53] If Motherwell wished to obtain earlier wheat harvests, he should have followed the advice he gave Richard Waugh of Winnipeg in 1907 and cultivated Stanley or Preston.[54]

With meticulous care Motherwell cultivated his oat crop. Following John Bracken's advice he undoubtedly seeded the finest quality Banner, and perhaps at a later stage Victory.[55] His workmen paid special attention to harrowing. Major McFadyen recalls that oats were harrowed as soon as they emerged.[56] Undoubtedly, Motherwell faced the perils of every oat grower. Wild oats infested his fields and caused Motherwell and his farmhands some concern. A local weed inspector, whom Motherwell labelled "an inspired jackass," even tried to prosecute him for spreading weeds.[57] Yet the oat-growing effort proved worthwhile. In 1914, a year of drought, Motherwell could boast of a crop averaging 40 bushels per acre.[58] Maple Flour Mills eagerly purchased his high quality crop.[59]

Described by his neighbour Ralph Steuck as "the bromegrass king," Motherwell successfully harvested greater quantities of the Austrian import than perhaps any other farmer in Saskatchewan. The key to his success lay in seeding the fodder over a large acreage. In 1909 he could claim a harvest of 12,000-13,000 pounds of cleaned seed from an expanse of 60 acres.[60] To obtain satisfactory yields he undoubtedly practised modern cultivation techniques. He likely seeded 20 pounds per acre in the spring on moisture-laden land and cut his crop in early July.[61] But a number of things troubled Motherwell. He had a difficult time eliminating the grass once it had established itself on his fields.[62] After threshing in the prescribed fashion[63] Motherwell encountered problems in cleaning his seed. In 1909 he purchased a bromegrass cleaning machine, but failed to use it. The brome in a polluted state, the Steele-Briggs Company in Winnipeg purchased his annual harvest.[64]

The final crop in Motherwell's pattern, winter rye, was sown to clear the land of weeds which infested his oats and bromegrass. The crop could either be used as pasturage or sold as low grade hay.[65] Seeded on summer fallow in late August and at the rate of one bushel per acre, the seedlings emerged during the autumn.[66] The following July Motherwell could reap his harvest. As a cleaning crop, rye proved valuable because it occupied lands that would normally support wild oats in early spring and frequently eliminated their sources of nutrition.[67]

A comparative study of Motherwell's forage crop practices with the wheat grower's typical rotation pattern indicates that the former's efforts proved unprofitable while the judicious wheat grower could realize a small return. Seeding 340 acres annually during 1907-14 and following an oats, oats, summer fallow pattern Motherwell probably harvested 140 acres of oats annually as well as 70 acres of winter rye and 60 acres of bromegrass. In 1915 he adopted the complex rye, oats, brome, brome, summer fallow pattern and proceeded to cultivate 480 acres. Divided into four equal plots he could claim 120 acres of rye, oats and brome during 1915-19. On the other hand, most farmers followed a wheat, wheat, oats and summer fallow pattern. For the sake of comparison, a contemporary of Motherwell would sow 170 acres wheat and 85 acres oats during 1907-14 and 240 acres wheat and 120 acres oats for the later period.[68] Lower overhead combined with higher returns indicate that wheat growing was more profitable.

Table 1. Acreages Sown, 1907-19 - Motherwell vs. Typical Grain Grower

	Motherwell's Farm				Typical Wheat Farm		
Years	Rye	Oats	Brome-grass	Fallow	Wheat	Oats	Fallow
1907-14	70	140	60	70	170	85	85
1915-19	120	120	120	120	240	120	120

High yields of Motherwell's forage crops could not compensate for the minimal returns he secured. His most successful fodder, oats, frequently produced harvests over 40 bushels per acre and reached a height of 45.9 in 1915.[69] However, bushel prices under 45¢

transformed oat growing into a financially futile exercise. Bromegrass netted similar results. This grass produced seed in great profusion that was worth a mere 7¢ per pound before World War I. Before 1914 no known market existed and it was probably grown solely as a weed killer. Several years later harvests of only 11.5 bushels per acre prevented him from disposing of large amounts of fodder at $1.50 per bushel.[70] Wheat growers had no problems selling their crops at realistic prices. Sums estimated at over $2 per bushel after 1916 and never under $3 ensured farmers of a fair return despite yields ranging as low as 8.5 bushels per acre in 1919.[71] Even a farmer with a poor wheat crop realized a greater return than his oat-growing compatriot.

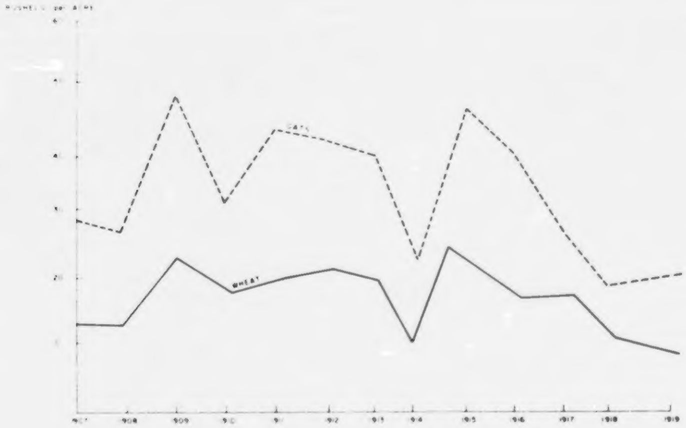

Figure 3. Yields per acre - wheat & oats.

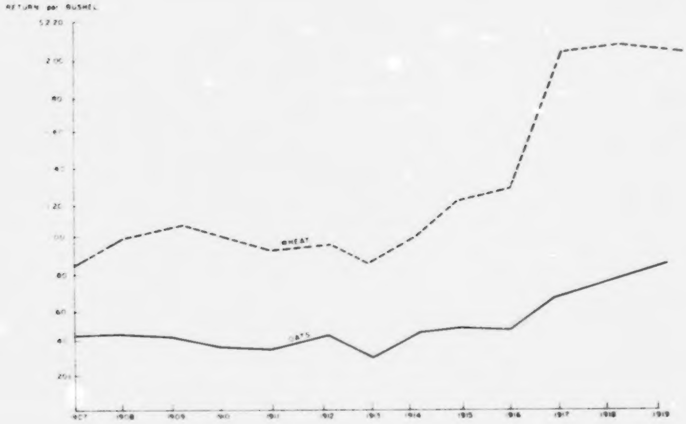

Figure 4. Returns per bushel - wheat & oats.

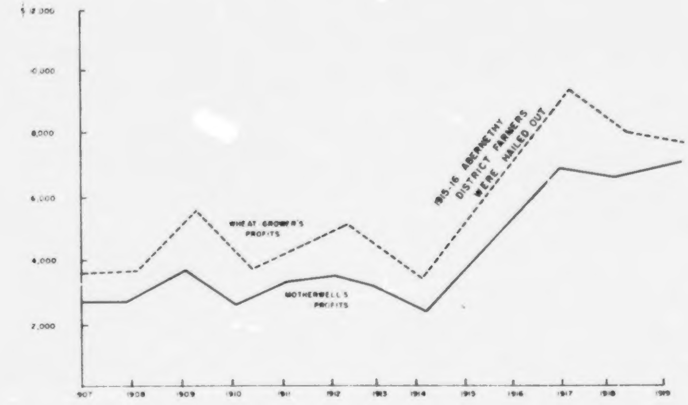

Figure 5. Returns before deductions - grain growing vs. forage cultivation.

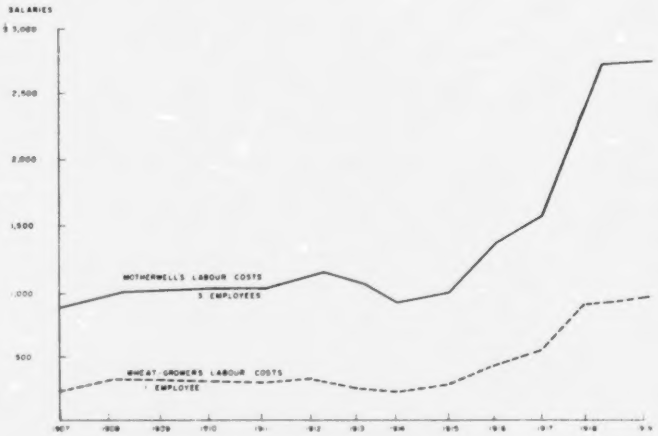

Figure 6. Labour costs - Motherwell vs. grain grower. (Tabulated from Saskatchewan Department of Agriculture *Annual Reports*, 1907-20.)

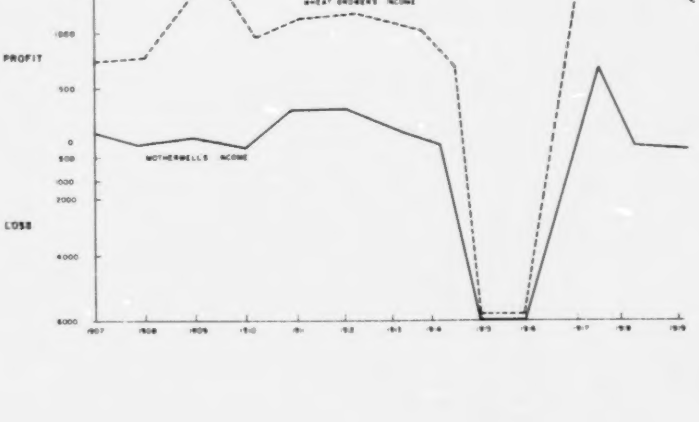

Figure 7. Profit and loss deductions - Motherwell vs. grain grower.

Before the deduction of overhead costs the typical wheat-grower's income surpassed Motherwell's during each year between 1907 and 1919. Motherwell's pre-1915 oats and brome returns could not equal the average grain-growers' wheat and oats harvest. While Motherwell's total income would have fluctuated somewhere between $2276.12 in 1914 and $3580.57 five years earlier, his counterpart's income ranged from $2853.11 to $5603.83 for the same years. During World War I, returns increased as a result of high prices. Motherwell's income from rye, oats and brome exceeded the wheat grower's in 1919 but federally controlled prices made this occurrance an exception. In 1917 and 1918 the return of the latter dominated by 50 and 14 per cent, respectively.[72] Only in 1915 and 1916 did neither register a profit; all crops in the Abernethy District succumbed to hail.[73]

High overhead kept profits to a minimum for the average grain grower while eliminating any opportunity Motherwell possessed of securing any return. According to a tabulation made from the 1918 Annual Report of the Saskatchewan Department of Agriculture, overhead costs reduced a field husbandman's income for wheat to 35 per cent of the price per bushel.[74] This figure appears equally applicable to bromegrass, rye and oats. Moreover, high labour costs ate away most of the remaining profits. Unlike his contemporaries who employed only one permanent hired hand Motherwell had two or three. Salaries ranging as high as $900 per man in 1918-19 diverted potential profit. While his neighbours could expect to derive small incomes from their operations Motherwell's losses were estimated at up to $463.45 for his forage-growing operations alone.[75] Motherwell survived on his ministerial salary.

Mechanization at Lanark Place

Throughout his ministerial tenure Motherwell purchased modern farm implements but did not follow the trend away from horsepower to the gasoline or kerosene tractor. Clinging to the use of the Clydesdale horse he used his animals to pull sophisticated ploughs, harrows, discs and cultivators. Motherwell conducted his operations with six horse teams. Attached to a John Deere 28 two-furrow plough, his horses could till six acres per day. On summer fallow his disc harrow removed weeds before they could spread to adjacent cultivated fields.[76] By 1916 Motherwell even possessed a duckfoot cultivator, a device that he utilized for removing unwanted bromegrass, but also one which could eliminate deeply rooted weeds while improving soil conditions.[77] Most unusual among the Motherwell's implements was his Lacrosse drill, a brand he alone in the district owned and for which parts were scarce.[78] Motherwell's employees took good care of his horse-drawn tools. Housed in a shed constructed before 1905, plough, drill and cultivator received regular inspection and lubrication.[79] Only the tractor was missing.

Threshing at Lanark Place was a major undertaking. Before 1911 Englehart, John and Conrad Steuck drove their self-propelled steam threshing machines with its accompanying trailer onto the Motherwell farmstead. At least 20 men hauled the stooks that Motherwell and his workmen had so meticulously erected. They inserted the grain into the jaws of the whirring 36-inch separator powered by a hissing 60-horsepower behemoth steam engine. At the rate of 3000 bushels per day the seed was separated from chaff and straw.[80] In 1911 Motherwell's purchase of a portable Hart-Parr engine and threshing machine altered procedures slightly. The Agriculture Commissioner no longer required the Steuck brothers' assistance for threshing. Connected to a small separator the Hart-Parr engine performed the duties of the heavier steampowered unit.[81] Yet the demand for large numbers of workmen remained. Motherwell still needed draymen to haul the stooks from the fields to the new threshing machine.

Before 1920 Motherwell's reluctance to purchase a tractor was not viewed as a sign of unwavering conservatism by his contemporaries. Despite the fact that the light gasoline-powered tractor had been perfected and that the federal government had entered into an agreement with Henry Ford to distribute his Fordson tractor at cost price to the farmer, few residents of the Abernethy District purchased the new machines. Established residents such as the Bittners and Steucks continued to plough, seed and harrow with the ubiquitous Clydesdales. Jack Bittner's family, Motherwell's neighbours, worked three or four farms with 24 horses.[82] Only during the succeeding decade would Motherwell's reluctance to mechanize be seen as old-fashioned.

Animal Husbandry Practices, 1904-18

Stock rearing complemented Motherwell's forage-growing endeavours. Large numbers of Clydesdale horses, Shropshire sheep, and lesser quantities of Holstein and Shorthorn cattle and various breeds of hogs were housed in the huge barn at Lanark Place. Despite the scale of his operation the Agriculture Commissioner followed sub-standard practices. The immense barn erected on the farmstead could not boast a Rutherford ventilation system even though Motherwell was probably well acquainted professionally with this individual and his work.[83] Moreover, the structure housed inferior livestock. Throughout his entire farming career Motherwell did not own a single purebred horse. With the notable exception of sheep, and before 1922, of Holstein dairy cattle, he bred animals of dubious parentage. He ignored the advice of the agricultural press and the agricultural college.

As a mixed farmer Motherwell surprisingly raised only a few beef cattle during his term as provincial Agriculture Minister. In all likelihood he raised only sufficient Shorthorns to meet household needs. His inventory included no purebred stock; even the occasional Shorthorn bull that he owned was not pedigreed.[84] Perhaps the most important aspect of beef cattle rearing, breeding, he left to others.

His neglect of this important line of animal husbandry is unexplainable. With abundant and succulent brome pasturage and a constant supply of water derived from frontage on Pheasant Creek, his farmstead possessed all the ingredients for sustaining large numbers of beef cattle. His neighbours and contemporaries obviously thought differently. The Bittner family raised 20-30 head of beef cattle along with a purebred bull.[85] Motherwell's contemporary at the Ontario Agricultural College and his chief competitor for academic honours, Richard James Phin, exported 1000 head of beef cattle annually from his Moosomin farm.[86] Motherwell's Alberta contemporary, Duncan Marshall, a fellow Liberal and Minister of Agriculture during 1909-21, engaged in extensive cattle rearing. After owning several purebred Shorthorns as a child in Southern Ontario, he purchased a farm in Alberta and increased the size of his operations. Marshall's Shorthorn-breeding endeavours were so successful that he proudly entered purebred bulls in livestock competitions at Edmonton, Calgary and Brandon in 1915 and 1916.[87] Motherwell could not equal the achievements of his neighbours and peers.

Motherwell's cattle-rearing attempts were oriented in the direction of dairying. Even here his stock was sub-standard and his breeding techniques questionable. Before 1913 few Holsteins matured on Lanark Place. Only a sufficient number of cattle were retained to provide a household milk and butter supply. In that year a number of Abernethy District farmers decided to enter the dairying business. Motherwell eagerly joined Englehart Steuck and several unnamed others in the venture. Soon he had acquired a maximum of 24 female non-pedigreed Holsteins and retained this number until 1922. He purchased these cows at wholesale prices.[88] Feeding them brome hay, he shipped the milk they produced in five- and ten-gallon cans to the dairy at Indian Head.

It seems Motherwell did not pay particular attention to the breeding of pure stock. At one point he even mated Shorthorn bulls with Holstein cows.[89] The results were predictable. A resident of the Motherwell household, Margretta Evans Lindsay, noted that the offspring "were of dubious parentage as they were not the usual black and white colour."[90] One might presume that his mongrel stock provided only a limited milk supply, although Motherwell may have been concerned with their capacity to provide beef as well as milk. Such leading husbandmen as W.J. Rutherford and A.E. Wilson would have scoffed at anything other than using purebred bulls on high quality females of a similar breed. In 1922 disease infected Motherwell's herd and his animals were butchered with probably little financial loss.[91]

Motherwell's neighbours and colleagues practised superior dairy-cattle breeding. The Bittner family mated purebred Holstein bulls with grade cows in the accepted manner.[92] Undoubtedly the most proficient of Abernethy District breeders was John Steuck. After purchasing a purebred bull and cow from John Williams of Lyons, Ontario, in 1913 he embarked on a career of purebred Holstein production. From 1916 to 1920 he sold many fine dairy cattle.[93] Motherwell's Livestock Commissioner, P.M. Bredt, achieved equally fine results. After a long farming career in Germany he put together an excellent herd upon mating high quality stock purchased in Southern Ontario.[94] The efforts of Motherwell's neighbours and associates put his dairy cattle breeding endeavours to shame.

Within the confines of the huge red barn at Lanark Place hogs and poultry were fattened only for household consumption. Motherwell did not consider commercial operations economically viable. Hog feed, for instance, had to be purchased commercially at an exorbitant cost.[95] Constantly shifting from one breed of hog and chicken to another and cross breeding indiscriminantly, he produced staples of the dining room table. Insofar as chicken rearing is concerned, he raised two varieties. The Plymouth Rocks so common to the Prairies that he matured before 1914 were supplanted by Bard Rocks in 1918-19.[96]

At various times he raised Tamworth Berkshire, and Yorkshire swine.[97] Like his dairy cattle breeding endeavours his attempts at increasing his hog population were primitive. During his entire farming career, only once did he permit himself the luxury of owning a purebred pig. A Tamworth sow, purchased in 1915 from the College of Agriculture at the University of Saskatchewan, proved less useful than a boar of the same breed.[98] He persisted in cross breeding such varieties as Berkshires and Yorkshires and ultimately owned a menagerie of swine that differed radically from one another in colour and in bacon quality.[99] By contravening the warning issued by experts to mate only purebred boars with sows of the same caste, he confined himself to accumulating a motley array of stock.[100]

Only in the realm of sheep raising did Motherwell register some success. Alone among Abernethy District farmers he entered this line of livestock production wholeheartedly. Although he may have possessed non-pedigreed sheep before 1915 his Shropshire-breeding attempts date from that year. Acquiring ten purebred ewes from William C. Sutherland, M.L.A. and one-time Speaker of the Saskatchewan Legislature, he added a University of Saskatchewan-bred ram one year later,[101] and increased his flock to 14 by 1918 and to 25 by 1919.[102]

Under virtually ideal conditions his sheep matured. Housed in the barn, they pastured on a specially designated field behind this structure, probably terrain seeded with bromegrass. Succulent feed and plentiful water fostered rapid growth to a weight of 175-225 pounds for rams and 140-175 pounds for ewes.[103] The Shropshire was, of course, an ideal breed of sheep. Motherwell could butcher his animals for mutton unequalled by any other prairie stock grower. But it seems unlikely that he raised purebreds for such pedestrian purposes and instead probably sold his stock for breeding. It is also recorded that after 1918 he marketed the long strands of fairly high quality wool produced by his hairy beasts.[104] In sheep raising alone Motherwell had triumphed.

Horses occupied the greater portion of the Lanark Place stable. Possessing as many as 32 Clydesdales in 1914, Motherwell raised them in a fashion similar to that of his contemporaries. During the daylight hours of winter and at times of farm inactivity, the animals pastured on the extensive forage acreage. At night workmen led the large draft animals to their respective stalls in the barn. Overhead feeders then carried the daily oats ration to each horse's individual trough.[105] Water from the dugout assisted the burly animals in digesting their energy-producing grain ration.

Care in working the Clydesdales prolonged their lives as purveyors of grain-growing equipment. In his correspondence, Motherwell warned his farm superintendent to introduce the animals to heavy labour only in increasing increments each spring. Light harrowing would precede shallow and later deep ploughing. The comfort of his horses also concerned Motherwell - a tight, properly fitted harness and collar enabled a horse to perform its duties faithfully.[106] Only a healthy draft animal proved profitable.

Despite his contemporary horse-rearing practices, Motherwell cannot be viewed as a leader in this line of husbandry. The large number of horses he owned were not needed for cultivating his medium-sized spread. With a maximum of two six-horse teams being used at any given time, at least 20 horses stood idle daily. The only value in having a large number of Clydesdales literally eating away his profit margin may have been political. The unceasing flow of visitors to Lanark Place probably associated quantity with farming efficiency. But this was an erroneous assumption to make for throughout the entire period Motherwell did not possess one purebred Clydesdale stallion and did not engage in extensive breeding. The only recorded instance of the latter occurred in 1910 when he rented John Steuck's stallion, "Stormer" to perforom indiscriminately with his assortment of Clydesdale mongrels.[107] The patriarch had merely accumulated an assortment of second-rate horses to flaunt his non-existent wealth at both neighbour and visitor.

Motherwell's neighbours utilized their equine resources more efficiently. The Bittner family worked three or four farms with two dozen horses.[108] With six horses stationed on each of four farms it is conceivable that all of them may have been worked simultaneously. Two of the three Steuck brothers, Englehart and John, engaged in purebred Clydesdale breeding. While Englehart possessed only one stallion, "Golden Rory," in 1908, at least he made an attempt to improve his Clydesdale stock. On the other hand, his brother became the most important breeder in the Abernethy District. Beginning in 1906 with the purchase of a stallion from A.B. Hamilton of Indian Head and a mare from E.R. Ross of Derryville, Ontario, he proceeded to acquire such distinguished stock as the Scottish-bred stallion, "Craigie Commander," six years later.[109] At regular intervals he could market purebred stallions and mares including one annually in 1911, 1913, 1914, 1915, two in 1917 and 1918, and three the year after the armistice.[110] While his neighbours were determined to utilize their Clydesdales efficiently and upgrade regularly, Motherwell lacked initiative.

In the realm of livestock rearing Motherwell had not lived up to the standards for which he strove during his homesteading years. Motherwell the innovator was dead, only to be replaced by the arch-conservative prairie patriarch. Since questionable livestock-rearing methods had enabled him to survive before 1904, he completely forgot they had been undertaken because of his lack of capital. Housing his stock in a grandiose but ill-ventilated barn, he proceeded to commit all the livestock errors at which his former O.A.C. instructors would have scoffed. Cross breeding mongrel Berkshire and Yorkshire hogs and Shorthorn and Holstein cattle, he reduced his stock to the scrub level. Even in his own district the leadership role in animal husbandry fell to others.

As a farmer during his term as Saskatchewan's Minister of Agriculture, Motherwell had for all purposes ceased to employ the processes of experimentation and observation that had contributed to his farming successes before 1905. His preoccupation with his political career led him to devote most of his energy within the confines of his verdant, but profit-sapping farmstead. Motherwell's conservatism was reflected in his agricultural practices. While wheat established its hegemony he continued to seed large crops. The sheer expense of employing year-round labour and the limited demand for his oats, bromegrass and rye led to constant financial losses. Poor animal husbandry practices exacerbated the situation. Motherwell continually subsidized his farming operations with his ministerial salary while his neighbours registered small but regular returns.

THE LATER PERIOD, 1921-43

Motherwell's farming practices changed little from the earlier period after he assumed responsibilities as Canada's Minister of Agriculture. Although he did seed some wheat on the 320 acres he cultivated,[1] his rotation pattern continued to stress bromegrass and other forage. Both his field and animal husbandry endeavours possessed the earlier shortcomings. At a time when mechanization was reducing the number of farm labourers necessary for producing bumper crops Motherwell employed his usual two or three workmen plus a foreman. In horse, swine, and cattle rearing he followed methods that had proven obsolete twenty years earlier. Only his salary as Canada's Minister of Agriculture stood between him and bankruptcy.[2]

Only through the reminiscences of Motherwell's former employees can we arrive at an understanding of the Abernethy patriarch's post-war cropping patterns. Our most reliable information source, the Motherwell Papers contain no correspondence for these twilight years of his career. No evidence, either from interviews or written sources can determine the rotation pattern followed on the fertile lands adjacent to Pheasant Creek. We can only be certain that Motherwell seeded a huge garden complete with potatoes, corn, and watermelons during the twenties and thirties,[3] and that his apples and plums blossomed each June until the trees succumbed during the drought of the thirties.[4] On the other hand it is reported that Motherwell harvested sizeable grain crops and brome forage during the early 1930s while his neighbours' soil was swept away by the relentless prairie winds.[5] At best, the Abernethan's field husbandry practices remain a topic for speculation.

Motherwell's sizeable grain harvests during the early 1930s suggest that he practiced techniques that not only allowed the soil to retain its moisture but develop an adhesion that resisted the infamous winds. It is quite possible that he accepted the advice profferred by Seager Wheeler in his dry-farming guide, *Profitable Grain Growing*. To retain the moisture caused from melting of winter snows, Motherwell may have used his spring-tooth cultivator to corrugate his fields. "Using it over the field that has been well fined previously will throw up ridges and open up forrows. The ridges hold back the water and the furrows receive it, to percolate down into - the seed bed, but the root bed, the place where the plant takes up the food necessary for vigorous growth."[6] Motherwell may also have acquired a soil-packer. As a attachment to a plough this device reduced evaporation even further by firming the top soil.[7] Perhaps the key to Motherwell's ability in preventing soil drifting lay in utilizing bromegrass as a rotation crop. The tendency of this crop to establish an extensive underground root network made his topsoil impervious to drifting. Through an understanding of the principles of soil moisture preservation and the

Figure 8. Feeding pigs, Lanark Place, 1930s. (Motherwell Collection, Parks Canada, Prairie Regional Office.)

Figure 9. Feeding chickens, Lanark Place, late 1930s. (Motherwell Collection.)

control of drifting, Motherwell kept his soil in good condition.

While his neighbours mechanized, Motherwell continued to pursue his old labour-intensive farming practices. Employing two or three permanent workmen cost him $800-$1200 annually during the 1920s,

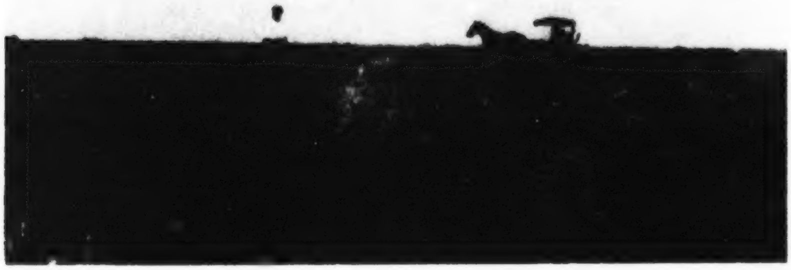

Figure 10. J.B. Gillespie, farm manager, inspecting hay stooks, ca. 1930. (Motherwell Collection.)

Figure 11. Threshing grain in the Lanark Place working field, 1940s. (Motherwell Collection.)

unnecessary overhead that reduced his profit margin.[8] A possible error in judgement was his appointment of an in-law, J.B. Gillespie, as farm superintendent in 1922. Gillespie's effectiveness in field and animal husbandry is not known, but the farmstead grounds certainly suffered under his tenure.[9] To undertake his threshing, Motherwell called upon his son Talmadge who operated a Rumely oil-pull tractor and separator.[10] These practices marked Motherwell perhaps as a traditionalist for his neighbours, the Bittners, purchased their first International-Harvester Titan tractor with separator in 1922[11] and reduced the number of hired hands. Another Abernethy District farmer, Richard Penny, purchased a similar machine during the same period.[12] While Motherwell's overhead remained constant his peers reduced their labour costs.

At the same time, it should be stated that while Motherwell sacrificed immediate profits in employing extra manpower in lieu of new machinery, he was in a fairly strong positon to withstand the worst effects of the Depression after 1930. His debt-ridden neighbours, having invested heavily in the new machinery, watched helplessly as the twenties' bubble of prosperity burst and their earlier gains evaporated. In this respect there was a certain ironic vindication for Motherwell's traditional, but methodical ways.

Few improvements in animal-rearing techniques were undertaken at Lanark Place during 1921-43. Motherwell reared only cattle, hogs, and draft horses of imperfect parentage. After the untimely destruction of his scrub Holsteins he turned to beef-cattle husbandry on a small scale. During the Depression he kept six cows, including two calves and four 1200-2000-pound steers of either Shorthorn or Aberdeen Angus stock.[13] A sizeable number of hogs supplemented the cattle. Fed on commercially produced corn, his swine pastured on a pig-run near the dugout.[14] Draft horses completed his livestock inventory. Reduced to a total of 14 during the 1930s in line with the decrease in cropping, these animals retained their undistinguished status.[15] With the use of mixed-blood sires Motherwell probably bred his stock indiscriminately.

Motherwell's efforts fell short of his peers in other respects. Throughout the 1920s and 1930s John Steuck practised more advanced husbandry techniques than his illustrious counterpart. While Motherwell turned to beef cattle, Steuck bred high quality Holsteins. Stud records for 1920, 1923, and 1929 indicate that Steuck constantly improved his herd.[16] Steuck soon turned his attention to beef-cattle breeding. He purchased purebred Aberdeen Angus bulls and cows during the late 1920s and early 1930s and proceeded to propagate choice examples of the species.[17] On a more limited scale he undertook breeding Clydesdale horses and Suffolk sheep. Motherwell could not equal the scope and foresight of such a dedicated animal husbandman.

Innovation thus played a minimal role in Motherwell's farming activities while he presided over the nation's agricultural policy. The benefits that modern moisture conservation techniques could provide were negated by Motherwell's rejection of mechanization, his tendency to utilize labour-intensive methods, and his insistence on cultivating an over-sized garden. As a livestock producer he followed the primitive techniques of his homesteading years. One workman accurately described his operations when he sardonically commented that the farm continued its precarious existence only through regular injections of Ottawa-earned funds.[18] Despite an impressive administrative career, Motherwell's practices had ceased to provide an example for his fellow farmers.

CONCLUSION

In 1943 Motherwell died and bequeathed a farming legacy that fell far short of initial expectations. As a homesteader he had transformed a segment of the windswept prairie into an oasis where grain matured and livestock thrived. But he had accomplished this feat in splendid isolation. North of the Qu'Appelle Valley where the railroad did not pass until 1904, economics and geography dictated that he utilize the farming methods of Eastern Ontario (with some modifications) to survive. By pasturing his humble Shorthorns on luxuriant strands of bromegrass and selling his vegetables in Fort Qu'Appelle, he created for himself a farm that was both practical and profitable. Unfortunately his early farm experiences led him to believe that Eastern Ontario farming practices undertaken on a vast scale would prove the farmer's salvation. In his eyes Lanark Place would constitute a contribution to prairie agriculture - to others it would remain an enigma.

Indeed, Lanark Place possessed the attributes of a rational synthesis of Eastern Ontario concepts with prairie reality. As a horticulturalist Motherwell cultivated a garden that was both productive and modern. Most Ontario vegetables could be successfully nurtured under dry-belt conditions. Convinced of the efficacy of fruit growing, Motherwell, like so many of his peers, transplanted the wild berries of Southern Saskatchewan in his garden plot and transformed these fruits into a desirable delicacy. Even the decision to grow oats and bromegrass was rational. Utilizing the soil-moisture preservation techniques discovered through trial and error, Motherwell experienced forage yields that vastly exceeded potential wheat harvests. Eastern Ontario farming practices would certainly make the Prairies productive.

Despite his failure to comprehend its ramifications, the railroad shattered Motherwell's hope of creating an isolated Arcadia. The wheat bushel, in spite of its waverings upon the commodity exchanges of Winnipeg, would reign supreme. Moreover, livestock would have to be raised quickly and efficiently to provide steady incomes to their producers. The farmer who minimized his overhead and adopted the new technology would survive while the traditionalist fell to the wayside. Unfortunately, Motherwell chose the latter course, but continued farming as a result of his ability to draw a salary elsewhere. While his neighbours minimized their labour costs, he spent large sums employing hired hands on his farmstead. As others cultivated greater and greater wheat acreages to take advantage of advancing prices, Motherwell clung to the fodders of his ancestral home. Even as neighbours improved their livestock by mating females with purebred sires, Motherwell refused to join the bandwagon. While neighbours and associates prospered Motherwell experienced minimal monetary returns. At the same time, his traditional ways stood him in reasonable stead during the Depression of the thirties, when over-investment in machinery by his counterparts brought many of them to bankruptcy. Motherwell was a fairly typical farmer, who combined old ways with the new. His farming operations, considered progressive in the early period, inevitably suffered from his appointment to the Saskatchewan cabinet in 1905, which diverted most of his energy to public life. Any assessment of his personal farming practices must take his political career into account.

ENDNOTES

Motherwell as a Homesteader, 1882-1904

1 Alexander M. Ross, *The College on the Hill: A History of the Ontario Agricultural College* (Toronto: Copp Clark, 1974), p. 24.

2 Ontario, *Commission of Agriculture*, Report, Sessional Papers, pp. 531-32.

3 Anonymous, *Letters From a Young Emigrant in Manitoba* (London, 1883), p. 32.

4 The comparison has been made by examining the following: Ontario, *Annual Report of the Ontario Agricultural College*, Sessional Papers, 1881, 1882; Ontario *Annual Report of the Minister of Education*, Sessional Papers, 1882, pp. 34-35.

5 Ontario, *Annual Report of the Ontario Agricultural College*, 1881, 1882.

6 Ibid.

7 Alfred C. True, *A History of Agricultural Education in the United States*, 1785-1925. United States Department of Agriculture, Miscellaneous Publication Number 36 (Washington, 1929), pp. 178, 180.

8 Ibid., pp. 169-70.

9 Ian Clarke, *Motherwell Historic Park - Landscape and Outbuildings, Structural and Use History*, Final Report, Parks Canada (Winnipeg: Prairie Region, 1977), pp. 8-9.

10 Saskatchewan Archives, Saskatoon (hereafter cited as SAS), *W.R. Motherwell Papers*, File 3, No. 243, Assistant Secretary, Department of the Interior, Ottawa to W.R. Motherwell, Abernethy, N.W.T., 5 Oct. 1896.

11 SAS, *Motherwell Papers*, File 85, No. 12,405, receipt for Payment from Department of Interior, School Lands Branch, 15 March 1906.

12 Township Map - Indian Head North, ca. 1905, Ian Clarke, *Landscape and Outbuildings*, 1977.

13 SAS, *W.R. Motherwell Papers*, File 85, No. 12,462, W.R. Motherwell, Regina to F. Riley, Outlook, Saskatchewan, 1 April 1909.

14 SAS, *W.R. Motherwell Papers*, File 85, No. 12,414, Tax Invoice, Village of Fort Qu'Appelle, 11 Sept. 1906.

15 Motherwell's anonymous contemporary provides the following costs for homesteading: team of two oxen - $130, plough - $30, harrow - $12, mower - $80, and cow and two pigs - $35. Anonymous, *Letters from a Young Emigrant* (1883), pp. 97, 130. Jack Bittner, Motherwell's neighbour, speculates that Motherwell owned a plough, harrow and at a later date purchased a disc harrow, seed drill and binder. Jack Bittner interview, by Lyle Dick, agricultural questions prepared by David Spector, January 1978.

16 Ian Clarke, *Landscape and Outbuildings*, 1977, p. 8.

17 Canada, *Dominion Experimental Farm Reports*, Indian Head, Sessional Papers, 1890, pp. 272, 276.

18 SAS, *W.R. Motherwell Papers*, File 162, No. 23,306-09, Extract from *Prairie Farm & Home*, Christmas, 1914.

19 Ibid.

20 Canada, *Dominion Experimental Farm Reports*, Indian Head, 1890, p. 272.

21 SAS, *W.R. Motherwell Papers*, File 50, No. 6302, W.R. Motherwell, Regina to C.S. Noble, Alberta, 11 Jan. 1912.

22 Canada, *Dominion Experimental Farm Reports*, Indian Head, 1892, p. 227.

23 SAS, *W.R. Motherwell Papers*, File 162, No. 23,306-12, Excerpt from *Prairie Farm & Home*, Christmas, 1914.

24 Ibid.

25 Canada, *Dominion Experimental Farm Reports*, Indian Head, 1894, p. 364.

26 Ibid., 1896, pp. 396-97.

27 Alma Mackenzie, first interview, 1969.

28 Ontario, *Report of the Ontario Agricultural College*, Sessional Papers, 1882, p. 532.

29 Canada, *Dominion Experimental Farm Reports*, Indian Head, 1890, p. 282; 1892, pp. 292, 296, 297.

30 This assumption is based on the fact that Motherwell practised regular summer fallowing for his wheat fields after 1886. Since this technique proved profitable, it can be assumed that his garden received similar teatment.

31 Canada, *Dominion Experimental Farm Report*, Indian Head, 1890, p. 282.

32 SAS, *W.R. Motherwell Papers*, File 162, No. 23,307-8, Extract from *Prairie Farm & Home*, Christmas, 1914.

33 Interview with Jack Bittner, Abernethy, Saskatchewan, January 1978.

34 SAS, *W.R. Motherwell Papers*, File 162, No. 23,556-62, W.R. Motherwell, Abernethy to F.H. Auld, Regina, 28 Dec. 1934.

35 Ibid.

36 SAS, *W.R. Motherwell Papers*, File 58, No. 8910, W.R. Motherwell, Regina, to William Dick, Ladstock, Saskatchewan 26 Jan. 1909.

37 Ibid.

38 Selwyn H.H. Carrington, *Theme and Resource Assessment of the Motherwell Historic Site*, Report for Parks Canada, Prairie Region, 1976, p. 4.

39 "Cattle - A Few of the Beef Breeds," *Nor-West Farmer*, Winnipeg, Manitoba, April 1887.

40 SAS, *W.R. Motherwell Papers*, File 12, No. 1094, W.R. Motherwell, Regina to David Priest, Gully P.O. Saskatchewan, 14 Jan. 1908.

41 Motherwell's name fails to turn up in a search in the Dominion Shorthorn Herdbook for 1886-1910. Although registration of purebred animals was not compulsory, Motherwell's O.A.C. training would have convinced him of the importance of registering any purebred stock that he possessed. Canada, Department of Agriculture Library, *Dominion Short-Horn Herdbook*, Ottawa, 1886-1910.

42 Manitoba Archives Provincial Library. Annual Report of the Purebred Cattle Breeders' Associatoin of Manitoba and N.W.T., 1894-1898, Bound volume.

43 Angus Mackay, "Stock Feeding for Profit in the Territories," Nor'-West Farmer, March 1895, pp. 44-45.

44 "The Breeding and Herding of Cattle," Nor'-West Farmer, April 1886, p. 443; Angus Mackay, "Stock Feeding for Profit in the Territories," Nor'-West Farmer, March 1895, pp. 44-45.

45 Canada, Dominion Experimental Farm Report, Indian Head, 1893, p. 289.

46 John Bracken, Crop Production in Western Canada (Winnipeg,1920), p. 249.

47 SAS, W.R. Motherwell, File 72, No. 10,971-72, W.R. Motherwell, Regina, to F.O. Lyall, Montreal, Quebec, 23 Sept. 1909. For a complete assessment of the coyote's threat to the sheep industry see David E. Lantz, United States Department of Agriculture, Farmers' Bulletin No. 226, "The Relation of Coyotes to Stock Raising in the West" (Washington, 1905).

48 Before securing his draft horses, Motherwell owned oxen. He reputedly told his daughter that it was not possible to remain Christian and drive oxen. Alma Mackenzie, first interview, 1969.

49 Interview with Ralph Steuck, Abernethy, 8 June 1976, by Ian Clarke and Jack Bittner, Abernethy, January 1978, by Lyle Dick with agricultural questions prepared by David Spector.

50 Ian Clarke, Landscape and Outbuildings, 1977, p. 90.

The Ministerial Years

1 Canada, Department of Railways and Canals, Annual Report, Sessional Papers, 1905, p. xix.

2 North-West Territories. Department of Agriculture, Annual Report, Sessional Papers, 1898, pp. 8, 10-13; 1899, pp. 20-23; 1902, pp. 27-29; 1903, pp. 27-29.

yielded returns almost three times that of oats during the 1905-20 era. Saskatchewan, Department of Agriculture, Annual Reports, Sessional Papers, 1905-20.

4 F.W. Brodrick, "The Farm Garden," Bulletin No. 5, Manitoba Agricultural College (Winnipeg, November 1913), p. 3.

5 Jack Bittner interview, January 1978.

6 Saskatchewan, Department of Agriculture, Annual Reports, Sessional Papers, 1907, p. 108; 1917, p. 155. Reports list the going rates for farm labour with board and room.

7 The annual stipend for Saskatchewan's cabinet ministers was $5000. Saskatchewan, Public Accounts, Sessional Papers, 1907-18.

8 Interview with Jack Bittner, January 1978.

9 SAS, W.R. Motherwell Papers, File 83, No. 12,188, Steele-Briggs Seed Company, Winnipeg, to W.R. Motherwell, Regina, 5 July 1907.

10 SAS, W.R. Motherwell Papers, File 83, No. 12,174, W.R. Motherwell, Regina to Staller S. Stevens, Balcarres, Saskatchewan, 6 May 1907; File 84, No. 12,292-95, M.R. Mackenzie, Abernethy to W.R. Motherwell, Regina, n.d.

11 F.W. Brodrick, op. cit., p. 4. In 1907 Motherwell purchased a No. 12 Planet Junior Double Wheel-Hoe cultivator from Steele-Briggs

Seed Company in Winnipeg. AS, W.R. Motherwell Papers, File 83, No. 12,188, Steele-Briggs Seed Company, Winnipeg to W.R. Motherwell, Regina, 5 July 1907.

12 Ian Clarke, Landscape and Outbuildings, 1977, p. 83.

13 Major McFadyen interview, by Ian Clarke, 1976.

14 This statement is confirmed by Ian Clarke who states that Motherwell only irrigated his shelterbelt. Ian Clarke, Landscape and Outbuildings, 1977, pp. 83-84.

15 Western Canadian Society for Horticulture, Development of Horticulture on the Canadian Prairies: An Historical Overview, 1956.

16 Alma Mackenzie, first interview, 1969.

17 F.W. Brodrick, op. cit.

18 Alma Mackenzie, first interview, 1969.

19 For a description of the hot bed see Ian Clarke, Landscape and Outbuildings, 1977, pp. 84-85.

20 F.W. Brodrick, op. cit., p. 11.

21 L.C. Corbett, "Tomatoes," Farmers' Bulletin No. 220, United States Department of Agriculture (Washington: 1905), p. 8; W.R. Beattie, "The Home Vegetable Garden," Farmers' Bulletin No. 255, United States Department of Agriculture (Washington, 1906), p. 32.

22 W.R. Beattie, op. cit., p. 40.

23 F.W. Brodrick, op. cit., p. 10.

24 W.R. Beattie, op. cit., p. 26.

25 F.W. Brodrick, op. cit., p. 9.

26 Ibid., p. 11.

27 Alma Mackenzie, first interview, 1969.

28 W.F. Macoun, "Bush Fruits with Lists of Varieties Found Most Useful." Canada. Department of Agriculture, Bulletin No. 56 (Ottawa, 1907), p. 22.

29 Ibid., p. 37. Raspberries are only perennials with regard to their root systems. At the best the branches are biennial.

30 Canada, Dominion Experimental Farms Reports, 1917, Horticulture, Vol. III, p. 847.

31 W.F. Macoun, "Strawberry Culture with Descriptions and Lists of Varieties." Canada. Department of Agriculture, Bulletin No. 62 (Ottawa, July 1909), p. 7.

32 Alma Mackenzie, first interview, 1969.

33 Canada. Dominion Experimental Farm Reports, Indian Head, 1906, p. 394; 1908, p. 370; 1909, p. 347, 1911, p. 409.

34 Alma Mackenzie, first interview, 1969.

35 W.F. Macoun, "Bush Fruits," 1907, p. 31.

36 Canada. Dominion Experimental Farms Reports, Horticulture, 1917, Vol. II, p. 847.

37 Seager Wheeler tested over 200 varieties of apples, 100 varieties of crabapples, and a large number of plum and cherry varieties over 30 years. Western Canadian Society for Horticulture, Development of Horticulture on the Canadian Prairies: An Historical Overview, 1956, p. 17.

38 This figure is based upon the fact that Motherwell purchased 300 bushels of seed oats in 1908. Applying 2-3 bushels per acre, he sowed between 100 and 130 acres. AS, Motherwell Papers, File 83,

No. 12,203, W.R. Motherwell, Regina to G.A. McKinnon, Strassbourg, Saskatchewan, 10 Feb. 1908.

39 SAS, W.R. Motherwell Papers, File 82, No. 12,100, W.R. Motherwell, Regina to Steele-Briggs Seed Company, Winnipeg, 13 July 1909; File 82, No. 12,116, W.R. Motherwell, Regina to W.L. Oswald, Department of Agriculture, University Farm, St. Paul, Minnesota, 18 May 1912.

40 Canada. Dominion Experimental Farm Reports, Indian Head, 1910, p. 313.

41 Ibid., Brandon, 1912, pp. 67-68.

42 John Bracken, Dry Farming in Western Canada, (Winnipeg, 1921), pp. 186-87.

43 Jack Bittner interview, January, 1978.

44 Canada. Dominion Experimental Farm Reports, Vol. I, 1915, p. 285.

45 This is an estimate tabulated from Saskatchewan, Department of Agriculture, Annual Reports, 1905-12.

46 Jack Bittner interview, January 1978; Ralph Stueck interview, by Ian Clarke, 8 June 1976.

47 This figure is tabulated from Ontario, Bureau of Industries, Annual Reports, Sessional Papers, 1904, p. 33; 1909, p. 38; 1914, p. 34.

48 Ibid.

49 Saskatchewan, Department of Agriculture, Annual Reports, 1905-20. This assumption had been made after a rough comparison of average wheat and oat prices.

50 Ralph Steuck interview, Abernethy, 1976.

51 Jack Bittner interview, 1978.

52 In District I encompassing southeastern Saskatchewan, wheat seeding ended on May 12, 1911 and May 14 the following year while completion of oat seeding did not occur until May 30. Moreover, wheat was cut during the last week in August while oats awaited the beginning of September. Saskatchewan, Department of Agriculture, Annual Report, 1912, pp. 204-5.

53 Ibid., p. 206.

54 SAS, W.R. Motherwell Papers, File 50, No. 6269, W.R. Motherwell, Regina to Richard Waugh, Winnipeg, 13 Sept. 1907.

55 John Bracken, Crop Production in Western Canada, pp. 150-51.

56 Major McFadyen, Dan and Olive Gallant interview, by Ian Clarke, Abernethy, 1976.

57 SAS, W.R. Motherwell Papers, File 121, No. 17,283-84, W.R. Motherwell, Regina, to Allan D. Rowland, Dewar Lake, Saskatchewan, 28 Dec. 1916, Personal.

58 SAS, W.R. Motherwell Papers, File 35, No. 5077-79, W.R. Motherwell, Regina to W.M. Jardine, Dean of the Kansas, State Agricultural College, Manhattan, Kansas, 14 Sept. 1914.

59 SAS, W.R. Motherwell Papers, File 83, No. 12,223, W.R. Motherwell, Regina to James Morrison, Maple Lead Flour Mills Ltd., Abernethy, Saskatchewan, 21 Sept. 1909.

60 AS, W.R. Motherwell Papers, File 82, No. 120,103-04, W.R. Motherwell, Regina to Steele-Briggs Seed Company, Winnipeg, 21 Sept. 1909.

61 Charles V. Piper, Forage Plants and Their Culture (New York, 1914), pp. 197-99.

62 David Spector, Field Agriculture in the Canadian Prairie West, 1870-1940, With Emphasis on the Period 1870-1920, Manuscript Report Series No. 205 (Ottawa: Parks Canada, 1977), p. 54.

63 John Steuck of Abernethy described the threshing procedure as the following: "Take all the teeth out of the concave [of the separator] or if any are left in it set it low. Put in the oat sieve, shut most of the wind off and run the separator somewhat slower than for wheat or oats. See that the sieve is not loaded too much. Gauge the wind carefully and watch the sieve. I find it is better to blow the very light stuff over than to thresh it too dirty as it is rather hard to clean." Motherwell probably followed this advice. Quoted in John Bracken, Crop Production in Western Canada, p. 249.

64 SAS, W.R. Motherwell Papers, File 82, No. 12,100, W.R. Motherwell, Regina to Steele-Briggs Seed Company, Winnipeg, 13 July 1909.

65 John Bracken, Crop Production in Western Canada, p. 194.

66 SAS, W.R. Motherwell Papers, File 50, No. 6331-2, W.R. Motherwell, Regina to A.G. Holmes, Editor, Alsask News, Alsask, Saskatchewan, 26 Aug. 1914.

67 John Bracken, Crop Production in Western Canada, p. 195.

68 Table 1.

69 Figure 3.

70 SAS, W.R. Motherwell Papers, File 83, No. 12,237, W.R. Motherwell, Regina, to C.L.J. Travis, Govan, Saskatchewan, 13 June 1915.

71 Figure 4.

72 Figure 5.

73 SAS, W.R. Motherwell Papers, File 80, No. 11,574-75, W.R. Motherwell, Regina to Alan Mackenzie, Corefield, Saskatchewan, 12 Jan. 1917.

74 Saskatchewan, Department of Agriculture, Annual Report, 1918, pp. 13-14.

75 Figure 6. These figures are estimated from his field cropping alone. His household obviously consumed further funds.

76 Jack Bittner interview, January 1978.

77 SAS, W.R. Motherwell Papers, File, 121, No. 17,272, W.R. Motherwell, Regina to J.W. DeStein, Regina, 17 May 1916; Seager Wheeler, Profitable Grain Growing, 1919, pp. 187-88.

78 Jack Bittner interview, January 1978.

79 Alma Mackenzie, first interview, 1969.

80 Ibid., Jack Bittner interview, January 1978.

81 Motherwell purchased the Hart-Parr portable engine for $535 in 1911. AS, W.R. Motherwell Papers, File 83, No. 12,231, H.M. Walleser First National Bank, Charles City, Iowa, to W.R. Motherwell, Regina, 17 April 1912.

82 Jack Bittner interview, January 1978.

83 For a detailed study of the barn see Ian Clarke, Motherwell Historic Park - Landscape and Outbuildings, Structural and Use History, 1977, pp. 117-56. For an analysis of ventilation systems see pp. 148-51. A useful pamphlet on barn ventilation is L.J.

Smith, "Barn Ventilation," *Extension Bulletin No. 33*, Manitiba Department of Agriculture (Winnipeg, December 1918).

84 A search of the *Dominion Short-Horn Herdbook* indicates that he possessed no purebred beef cattle of this variety. *Dominion Short-Horn Herdbook* (Ottawa, 1899-1920).

85 Jack Bittner interview, January 1978.

86 *Canadian Parliamentary Guide*, 1919, p. 495.

87 Duncan Marshall, *Shorthorn Cattle in Canada* (Toronto, 1932), pp. 534-36. For a history of Marshall's breeding operations see pp. 532-39.

88 Jack Bittner interview, January 1978.

89 Ibid.

90 Margretta Evans Lindsay interview, by Lyle Dick, Regina, 2 Nov. 1977.

91 Jack Bittner interview, January 1978.

92 Ibid.

93 Holstein-Friesan Association of Canada, *Holstein-Friesan Herd Book* (Waterloo, 1892-1920).

94 George E. Reaman, *History of the Holstein-Friesan Breed in Canada*, Toronto, 1946, pp. 166-67.

95 SAS, *W.R. Motherwell Papers*, File 72, No. 11,040, W.R. Motherwell, Regina to John Bright, Livestock Commissioner, Department of Agriculture, Ottawa, 6 Jan. 1917.

96 Major McFadyen interview, 1976; Ralph Steuck interview, 1976.

97 Margretta Evans Lindsay interview, Regina, 2 Nov. 1977; by Lyle Dick; Jack Bittner interview, January 1978.

98 *Dominion Swine Breeders' Record*, Toronto, 1893-1942, The citation is taken from Tamworth, Vol. 26, 1915, p. 301.

99 Jack Bittner interview, January 1978.

100 W.H. Peters of the Manitoba Agricultural College warned that cross-bred stock possessed several disadvantages. Among these the inability of cross-bred stock to engage in satisfactory reproduction was most pronounced. W.H. Peters, "Hog Raising in Manitoba," *Bulletin No. 7*, Manitoba Agricultural College (Winnipeg, 1913).

101 *Canadian Parliamentary Guide*, 1915, p. 528.

102 Dominion Sheep Breeders' Association, *Canadian National Records for Sheep* (Ottawa, 1910-43). Statistics have been tabulated from this source on a year-to-year basis.

103 Grant MacEwan, *The Breeds of Live-stock in Canada* (Toronto, 1941), p. 417.

104 Ibid., pp. 418-19. Grant MacEwan states that the Shropshire produced fairly high quality wool although it could be marred by coarse strands or black fibres.

105 Major McFadyen interview, Ian Clarke, Abernethy, 1976.

106 SAS, *W.R. Motherwell Papers*, File 85, No. 12,313-14, W.R. Motherwell, Regina to Roderick McKenzie, Abernethy, 9 April 1908.

107 SAS, *W.R. Motherwell Papers*, File 83, No. 12,227, John Steuck, Abernethy to W.R. Motherwell, Regina, 19 July 1910.

108 Jack Bittner interview, Saskatchewan, January 1978.

109 Canadian National Live-Stock Records, *The Clydesdale Stud-Book of Canada*, Vol. 21 (Ottawa, 1913), p. 137.

110 Ibid., 1908-20.

The Later Period, 1921-43

1 Ted Callow interview, by Ian Clarke, 1976.
2 Dan Gallant interview, by Ian Clarke, 1976.
3 Margretta Evans Lindsay interview, Ian Clarke and Margie-Lou Shaver, 1976.
4 Dan Gallant interview, by Ian Clarke, 1976.
5 Ibid.
6 Seager Wheeler, *Seager Wheeler's Book on Profitable Grain Growing* (Winnipeg: Grain Growers' Guide, Ltd., 1919), p. 120.
7 Ibid., p. 130.
8 Saskatchewan, Department of Railways, Labour and Industries, *Annual Report*, Sessional Papers, 1929, p. 74.
9 By 1920 Motherwell's portable Hart-Parr engine had become obsolete. He did not replace the engine. Major McFadyen and Dan and Olive Gallant interview, 1976.
10 Ralph Steuck interview, January 1978.
11 Richard Penny interview, Abernethy, January 1978.
12 Ted Callow interview, Ian Clarke, 1976.
13 Dan Gallant interview, Ian Clarke, 1976.
14 Ted Callow interview, Ian Clarke, 1976.
15 Holstein-Friesan Association of Canada, *Holstein-Friesan Herd Book*, Vols. 22-32 (Waterloo, 1920-29).
16 Canadian National Live-Stock Records, *The Canadian Aberdeen-Angus Herd Book* (Ottawa, 1920-31).
17 Dan Gallant interview, Ian Clarke, 1976.

BIBLIOGRAPHY

Anonymous. 1883. *Letters from a Young Emigrant in Manitoba*. London.

Beattie, W.R. 1906. "The Home Vegetable Garden," *Farmers' Bulletin No. 255*. United States Department of Agriculture, Washington.

Bracken, John. 1920. *Crop Production in Western Canada*. Grain Growers' Guide, Ltd., Winnipeg.
---. 1921. *Dry Farming in Western Canada*. Grain Growers' Guide, Ltd., Winnipeg.

Brodrick, F.W. 1913. "The Farm Garden," *Bulletin No. 5*. Manitoba Agricultural College, Winnipeg.

Canada. Department of Agriculture Library. 1886-1910. *Dominion Short-Horn Herdbook*. Ottawa.

Canada. Department of Railways and Canals. 1905. *Annual Report*, Sessional Papers.

Canada. *Dominion Experimental Farms Reports*. 1890-1917. Indian Head and Brandon. Sessional Papers.

Canadian National Live-Stock Records. 1908-20. *The Clydesdale Stud-Book of Canada*. Ottawa.
---. 1920-31. *The Canadian Aberdeen-Angus Herd Book*. Ottawa.

Canadian Parliamentary Guide. 1915-1919.

Carrington, Selwyn H.H. 1976. *Theme and Resource Assessment of the Motherwell Historic Site*. Report for Parks Canada, Prairie Region, Winnipeg.

Clarke, Ian. 1977. *Motherwell Historic Park - Landscape and Outbuildings, Structural and Use History*. Final Report, Parks Canada, Prairie Region.

Corbett, L.C. 1905. "Tomatoes," *Farmers' Bulletin No. 220*. United States Department of Agriculture, Washington.

Dominion Sheep Breeders' Association. 1910-43. *Canadian National Records for Sheep*. Ottawa.

Dominion Swine Breeders' Record, 1893-1942. Toronto.

Grain Growers' Guide. 1906-25. Winnipeg.

Holstein-Friesan Association of Canada. 1892-1929. Holstein-Friesan Herd Book. Waterloo.

Lantz, David E. 1905. "The Relation of Coyotes to Stock Raising in the West," Farmers' Bulletin No. 226. United States Department of Agriculture, Washington.

MacEwan, Grant. 1941. The Breeds of Live-stock in Canada. Toronto.

Macoun, W.F. 1907. "Bush Fruits with Lists of Varieties Found Most Useful," Bulletin No. 56, Canada. Department of Agriculture, Ottawa.
---. 1909. "Strawberry Culture with Descriptions and Lists of Varieties," Bulletin No. 62, Canada. Department of Agriculture, Ottawa.

Manitoba Archives, Provincial Library
Annual Report of the Purebred Cattle Breeders' Association of Manitoba and N.W.T., 1894-1898. Bound volume.

Marshall, Duncan. 1932. Shorthorn Cattle in Canada. Toronto.

North-West Territories. Department of Agriculture. 1898-1903. Annual Report, Sessional Papers.

Nor'West Farmer. 1886-1895. Winnipeg.

Ontario. Annual Report of the Minister of Education, Sessional Papers, 1882.

Ontario. Annual Report of the Ontario Agricultural College, Sessional Papers, 1881, 1882.

Ontario. Bureau of Industries. 1904-9. Annual Reports, Sessional Papers.

Ontario. Commission of Agriculture. Report, Sessional Papers.

Peters, W.H. 1913. "Hog Raising in Manitoba," Bulletin No. 7, Manitoba Agricultural College, Winnipeg.

Piper, Charles V. 1914. Forage Plants and Their Culture. New York.

Saskatchewan Archives, Saskatoon
W.R. Motherwell Papers.

Saskatchewan. Department of Agriculture. 1905-20. Annual Reports, Sessional Papers.
---. 1907-18. Public Accounts, Sessional Papers.

Saskatchewan. Department of Railways, Labour and Industries. 1929. Annual Report, Sessional Papers.

Smith, L.J. 1918. "Barn Ventilation," Extension Bulletin No. 33, Manitoba Department of Agriculture, Winnipeg.

Spector, David. 1977. Field Agriculture in the Canadian Prairie West, with Emphasis on the Period 1870-1920. Manuscript Report Series No. 205. Parks Canada, Ottawa. (History and Archaeology series, this issue.)

Reaman, George E. 1946. History of the Holstein-Friesan Breed in Canada. Toronto.

Ross, Alexander M. 1974. The College on the Hill: A History of the Ontario Agricultural College. Copp Clark, Toronto.

True, Alfred C. 1929. A History of Agricultural Education in the United States, 1725-1925. United States Department of Agriculture, Miscellaneous Publication Number 36, Washington.

Western Canadian Society for Horticulture. 1956. Development of Horticulture on the Canadian Prairies: An Historical Overview.

Wheeler, Seager. 1919. Seager Wheeler's Book on Profitable Grain Growing. Grain Growers' Guide, Ltd., Winnipeg.